DOCUMENT RESUME

ED 295 798 SE 049 153

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TITLE Impact Study of Energy Education Workshops on the Participants and Their Peer Teachers.

PUB DATE May 83

NOTE 215p.; Ed.D. Thesis, University of Maine-Orono.

PUB TYPE Dissertations/Theses - Doctoral Dissertations (041) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC09 Plus Postage.

DESCRIPTORS *College Science; Educational Research; *Energy; Energy Conservation; *Energy Education; Fuels; Higher Education; *Inservice Teacher Education; Science Education; Science Teachers; Teacher Characteristics; *Teacher Education Programs; Teacher Improvement; *Teacher Workshops

IDENTIFIERS *Department of Energy

ABSTRACT

Energy issues have been the focus of scientists, science educators, politicians, historians, sociologists, and economists since the increase in fuel costs, passing of federal regulations on oil prices, changes in automobile standards, and increase in conservation measures. Many feel that educators have the responsibility of designing energy education for children and adults so that they will become energy literate. This study investigated the impact of two summer energy education workshops on the participants and the impact of the local inservice workshops conducted by the participants on the peer teachers. The study examined the following questions: (1) what were the characteristics of the workshop Department of Energy (DOE) participants (N=50) and peer teachers (N=29); (2) what effect did the workshops have on the participants; (3) what effect did the local inservice have on peer teachers; and (4) what were the similiarities and differences between the participants and their peer teachers? It was found that the participants included significantly more energy education topics in their school curriculum and used significantly more business or industry produced energy education materials and self-produced units than the peer teachers. The appendices include schedules of the energy workshops, demographic information about the participants, cover letters and survey instruments, and approaches utilized for incorporating energy education into the school curriculum. (RT)

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IMPACT STUDY OF ENERGY EDUCATION WORKSHOPS ON THE PARTICIPANTS AND THEIR PEER TEACHERS

By Betty Lorraine Bitner -Corvin

Thesis Advisor: Lloyd H. Barrow, Ph.D.

An Abstract of the Thesis Presented in Partial
Fulfillment of the Requirement for the Degree
of Doctor of Education

May, 1983

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The purpose of this study was to investigate the impact of two Department of Energy (DOE) summer energy education workshops, conducted at the University of Maine at Orono (UMO) during the summers of 1980 and 1981, on the 67 DOE participants and the impact of the local inservice energy education workshops, conducted by the DOE participants, on the 67 peer teachers, one selected by each DOE participant. This study defined impact study as a measure of the long-range effect, one or two years after the treatment. This study examined the following research questions: What were the characteristics of the DOE workshop participants and the peer teachers? What effect did participation in the DOE Faculty Development summer energy education workshops at UMO have on the DOE participants? What effect did participation in the local inservice energy education workshops, conducted by the DOE participants, have on the peer teachers? What were the similarities and differences between the DOE participants and their peer teachers?

The sample consisted of the 50 DOE participants who responded to the survey for participants and of the 29 peer teachers who responded to the survey for peer teachers. Both mail surveys were modifications

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of the Survey of the Current Status of Energy Education. Frequency distributions, chi-square statistic, and Spearman Rank Correlations were computed.

It was concluded that the DOE workshops at UMO had a significant effect on the DOE participants' teaching of energy education topics, on their curricular designs, and on their utilization of energy education curricular materials. Also, the peer teachers increased the number of energy topics in their school curriculum after participation in the local inservice energy education workshops. It was found that the DOE participants included significantly more energy education topics in their 1982-1983 school curriculum, used significantly more business or industry produced energy education materials and self-produced units or materials, and utilized both the unit within a course and the separate course curricular designs significantly more than the peer teachers.

The results of this study suggested that the UMO summer energy education workshops had positive effects on the DOE participants.

ACKNOWLEDGEMENTS

To the members of my committee, I extend my appreciation for their continuous dedication, advice, and expertise in the preparation and completion of this dissertation. To Lloyd H. Barrow, my advisor and chairperson, I express my deepest gratitude for his expertise and enthusiasm in this area of study; for his professional dedication, guidance, and constructive assistance in preparing, writing, and refining this study; and for his friendship throughout my two years of graduate school. To John W. Butzow, I express my appreciation for his constructive assistance and support in helping to design this study. To Constance C. Holden, I express my appreciation for her persistent direction and expertise in the analysis of data and in the presentation of the results of this study. To Constance M. Perry, I express my appreciation for her diligence, assistance and support throughout the writing process.

To Dianne King, I extend my appreciation for her patience and diligence in the typing of this dissertation.

To Anna Elizabeth Bitner and Arthur R. Bitner, Sr., my parents, I express my deepest gratitude for their perpetual love, support, and enthusiasm. Also, I express my appreciation to my siblings, John E. Bitner, Dorothy E. Boswell, and Arthur R. Bitner, Jr., for their love and understanding.

In addition, I extend my appreciation to Billie DeMont for her assistance and support during the initial stages of the dissertation. To George T. Davis, I express my appreciation for serving as a reader for my dissertation.

For their understanding, support, and assistance, I express appreciation to my friends at UMO: Rosemary Barrow, Susan O'Connor, Charles Gregory, Philip Kane, Susan Kane, Janice Kristo, James Maillett, Ralph Newbert, Mary Robinson, Carleton Vaughan, and Patricia Vaughan. Also, I extend my appreciation to the Mid-Coast Audubon Society and the Jamestown Audubon Society. To my Advanced Placement English 12 class at Rockland District High School during 1980-1981, I express my gratitude for their encouragement in my decision to obtain a Doctoral of Education in Science Education.

DEDICATION

This dissertation is dedicated to Annie May Wagner Foreman, my deceased maternal grandmother, whose love and encouragement have been driving forces in my pursuit of higher education.

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IMPACT STUDY OF ENERGY EDUCATION WORKSHOPS ON THE PARTICIPANTS AND THEIR PEER TEACHERS

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M.Ed. Edinboro State College, 1973

A THESIS

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Education

The Graduate School

University of Maine at Orono

May, 1983

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CHAPTER I

INTRODUCTION

Scientists, science educators, historians, economists, politicians, and sociologists have focused on energy issues since the mid 1970s when this country witnessed gasoline lines; the escalation of fuel prices; and the passing of federal regulations on oil prices, automobile standards, and conservation measures. The ramifications of this dilemma are broad with political, social, scientific and technological, economic, psychological, and ethical implications. Consequently, educators have the responsibility of designing energy education for children and adults so that they will become energy literate (i.e., capable of making intelligent and wise decisions concerning energy sources, the development of new sources, energy use, and conservation).

In response to the energy dilemma, in 1971, the Atomic Energy Commission (AEC) began to sponsor summer teacher workshops that focused on nuclear energy (Preston-Anderson, 1982). Subsequently, the oil embargo of 1973 and of 1978, the winter fuel shortages of 1976-1977, and the gasoline lines of the summer of 1979 ensued. These events were the impetus for energy education materials and workshops. Therefore, not only have the Department of Energy (DOE), the National Science Foundation (NSF), the National Science Teachers Association (NSTA), private industry, utility companies, and individuals funded and developed energy education materials, but also DOE and NSF jointly have sponsored 503 summer and academic year energy education workshops from 1971 through 1982 ("Faculty Development Workshops," 1982; Preston-Anderson, 1982).

Although copious energy education materials exist, and teachers have had the opportunities for preservice and inservice training and for summer energy education workshops for which both formative and summative evaluations are available, an impact study of these energy education workshops has not been reported.

Statement of the Problem

This study investigated the impact of the two DOE Faculty Development summer energy education workshops, sponsored by DOE and by the Colleges of Education and of Engineering and Science at the University of Maine at Orono (UMO) and conducted at UMO during the summers of 1980 and 1981, on the 67 DOE workshop participants and the impact of the local inservice energy education workshops, conducted by the DOE summer workshop participants, on the DOE participants' peer teachers, one selected by each DOE summer energy education workshop participant at UMO.

Both the 1980 and the 1981 DOE Faculty Development summer energy education workshops at UMO provided intensive interdisciplinary energy education, focusing on the scientific, economic, and technological aspects of energy, for inservice teachers and administrators, for energy resource personnel, and for other individuals interested in energy education concepts, curricular materials, and resources. The workshop format included lectures, laboratories, field trips, research, and curriculum development (see Appendix A for the workshop programs).

This study investigated the characteristics of both the DOE participants and their peer teachers, the long-range effect of the participation in the DOE Faculty Development summer energy education workshops at UMO on the DOE participants, and the long-range effect of the participation in the local inservice energy education workshops on the DOE participants' peer teachers. Previously, Barrow (1982) and Barrow and Holden (1983) reported on the effectiveness of the DOE workshops at UMO.

Definitions

This study utilized the following definitions:

DOE Participant. A DOE participant was a science, social studies, or industrial arts teacher, a school principal, or an energy resource person in Maine who participated in either the 1980 or the 1981 DOE Faculty Development summer energy education workshops at UMO.

Energy Education. Energy education is a multifaceted issue with historical, political, economic, ethical and moral, scientific and technological, occupational, psychological, environmental, and sociological implications; therefore, the public school system should offer a K-12 multidisciplinary approach to energy education.

Factors Influencing the Teaching of Energy Education. The factors influencing the teaching of energy education included the support of the school district administration, of the school board, and of the community; the teachers' and students' interest in energy education; the participants' and peer teachers' perception of energy education as a basic, and of their qualifications to teach energy education; and the principal's active support of energy education.

Impact Study. An impact study is a measure of the long-range effect, one or two years after the treatment.

Local Inservice Energy Education Workshops or Projects. The local inservice energy education workshops or projects were the workshops or projects conducted by the DOE participants and attended by the peer teachers.

Middle/Junior High School. Middle/junior high school refers to a school consisting of any of the grades five through eight.

Peer Teacher. A peer teacher was a teacher in Maine who participated in the local inservice energy education workshop and who from the DOE participant's perception was similar to the DOE participant in subject and grade level taught, in attitude toward energy, and in the number of years of teaching.

Principal's Active Support. Principal's active support involved both emphasis of energy education in the school curriculum and participation in the local inservice energy education workshop.

Secondary School. Secondary school refers to a school containing grades ten through twelve, and in addition may contain grades seven, eight, and nine.

UMO Workshops. The UMO workshops referred to the 1980 and the 1981 DOE Faculty Development summer energy education workshops sponsored by DOE and the Colleges of Education and of Engineering and Science at UMO.

Research Questions and Hypotheses

This study investigated the following research questions and null hypotheses:

Question 1.

What were the characteristics of the DOE workshop participants and the peer teachers?

Hypothesis 1.1. There is no significant difference between the 1980 and the 1981 DOE participants' energy education experiences prior to the UMO workshops.

Hypothesis 1.2. There is no significant difference between the 1980 and the 1981 peer teachers' energy education experiences prior to the local inservice energy education workshops.

Hypothesis 1.3. There is no significant difference between the 1980 and the 1981 DOE participants in the number of energy education topics taught prior to the UMO workshops.

Hypothesis 1.4. There is no significant difference between the 1980 and the 1981 peer teachers in the number of energy education topics taught prior to the local inservice energy education workshops.

Hypothesis 1.5. There is no significant difference between the 1980 and the 1981 DOE participants in the curricular materials utilized to teach energy education.

Hypothesis 1.6. There is no significant difference between the 1980 and the 1981 peer teachers in the curricular materials utilized to teach energy education.

Hypothesis 1.7. There is no significant difference between the 1980 and the 1981 DOE participants in the degree of their agreement with the factors influencing their teaching of energy education.

Hypothesis 1.8. There is no significant difference between the 1980 and the 1981 peer teachers in the degree of their agreement with the factors influencing their teaching of energy education.

Question 2.

What effect did participation in the DOE Faculty Development summer energy education workshops at UMO have on the DOE participants?

Hypothesis 2.1. There is no significant difference between the 1980 and the 1981 DOE participants in the kind of energy education topics included in their 1982-1983 school curriculum.

Hypothesis 2.2. There is no significant relationship between the DOE participants' recommended procedures for including energy education in the school curriculum and their curricular design.

Hypothesis 2.3. There is no significant difference between the science and non-science DOE participants in the energy education topics taught before and after the UMO workshops.

Hypothesis 2.4. There is no significant difference between the science and non-science DOE participants' perceptions of their students' energy conservation practices and knowledge of energy-related topics.

Hypothesis 2.5. There is no significant relationship between the DOE participants' perceptions of the factors influencing their teaching of energy education and the DOE participants' degree of agreement with energy education definition.

Question 3.

What effect did participation in the local inservice energy education workshops, conducted by the DOE participants, have on the peer teachers?

Hypothesis 3.1. There is no significant difference between the 1980 and the 1981 peer teachers in the kind of energy education topics included in their 1982-1983 school curriculum.

Hypothesis 3.2. There is no significant relationship between the peer teachers' recommended procedures for including energy education in the curriculum and their curricular design.

Hypothesis 3.3. There is no significant difference between the science and non-science peer teachers in the energy education topics taught before and after the local inservice energy education workshop.

Hypothesis 3.4. There is no significant difference between the science and non-science peer teachers' perceptions of their students' energy conservation practices and knowledge of energy-related topics.

Hypothesis 3.5. There is no significant relationship between the peer teachers' perceptions of the factors influencing their teaching of energy education and the peer teachers' degree of agreement with the energy education definition.

Question 4.

What were the similarities and differences between the DOE participants and their peer teachers?

Hypothesis 4.1. There is no significant difference between the DOE participants and the peer teachers in their previous energy education experiences.

Hypothesis 4.2. There is no significant difference between the DOE participants and the peer teachers in the kind of energy education topics included in their school curriculum before the workshops.

Hypothesis 4.3. There is no significant difference between the DOE participants and the peer teachers in the kind of energy education topics included in their 1982-1983 school curriculum.

Hypothesis 4.4. There is no significant difference between the DOE participants and the peer teachers in the kind of curricular materials utilized to teach energy education.

Hypothesis 4.5. There is no significant relationship between the DOE participants' and the peer teachers' recommendations for including energy education in the school curriculum and their curricular design.

Hypothesis 4.6. There is no significant difference between the DOE participants and the peer teachers in their agreement with the energy education definition.

Hypothesis 4.7. There is no significant relationship between the DOE participants' and the peer teachers' perceptions of the factors influencing their teaching of energy education.

Hypothesis 4.8. There is no significant difference between the DOE participants' and the peer teachers' perceptions of their students' energy conservation practices and knowledge of energy-related topics.

Hypothesis 4.9. There is no significant difference between the DOE participants and the peer teachers in their utilization of traditional and non-traditional primary home energy sources.

Need for the Study

A survey of energy education curricular materials conducted by Energy Information Associates (1978) indicated that abundant materials, some unidisciplinary and others multidisciplinary, such as the Project for an Energy-Enriched Curriculum (PEEC) developed by NSTA during the summer workshops for DOE, existed, but utilization of the materials was limited. Kooi (1979) and Miller (1979) completed studies on the effectiveness of PEEC. The Education Commission of the States (1979), the Ohio Department of Education (Energy Assistance Office, 1980 and 1981), and the Maine Office of Energy Resources of Maine (1981) conducted energy surveys to determine the extent of and need for energy education. Garey and Preston-Anderson (1980) and Preston-Anderson (1982) assessed the DOE Faculty Development summer energy education workshops. NSTA's PEEC (White and Fowler, 1983) conducted a survey to determine whether energy education was being taught and how teachers and principals supported the teaching of energy education.

Preston-Anderson (1982) and "Faculty Development Workshops" (1982) reported that the budget for the DOE Faculty Development Workshops from 1971 through 1982 was approximately $8.5 million for 503 summer and inservice workshops. With a budget this large, cost-effectiveness and accountability should be considered. Highwood and Mertens (1971) advocated impact studies for accountability; Welch and Gullickson (1973) and Welch (1978) advocated impact studies for planning and decision-making; and Bethel and Hord (1981) advocated impact studies for cost-effectiveness.

John M. Fowler, Director of PEEC, at the Third Annual Practitioners Conference (White and Hofman, 1981) outlined several needs for energy education, one of which was the need for evaluation of the impact of energy education programs. Also, Preston-Anderson (1982) recommended that follow-up evaluations be utilized to assess the continued impact of the workshops although workshop participants indicated enthusiasm for energy education during the workshops and at departure. Therefore, this study examined the characteristics of the DOE participants and of their peer teachers and investigated the impact of the DOE Faculty Development summer energy education workshops on the participants and the impact of the local inservice energy education workshops on the peer teachers.

Organization of the Remaining Chapters

The remainder of this study is divided into four chapters. Chapter II includes a review of related literature, focusing on the evolution of energy education, the goals of energy education, research in energy education, and impact study research. Chapter III explains the population and setting, the instrumentation, the administration of the instruments, a description of the sample, and the statistical analysis procedure. Chapter IV presents the findings of the study. Chapter V contains a summary of the design, the findings, discussion and conclusions, and recommendations for further research.

CHAPTER II

REVIEW OF THE LITERATURE

This study focused on the impact of the DOE Faculty Development summer energy education workshops on the participants and the impact of the local inservice energy education workshops on the participants' peer teachers.

The review of related literature focused on the evolution of energy education, the goals of energy education, energy education research, and impact study research.

The Evolution of Energy Education

Energy education was and is a response to the energy crisis. During the 1970's the United States witnessed oil production peaks, federal price controls on petroleum, and the escalation of natural gas production. In 1973, the Organization of Petroleum Exporting Countries (OPEC) imposed an embargo on oil exports to the United States (Buethe, 1981). Prior to the 1973 oil embargo, the United States consumed fossil fuels precipitously even though the United States' oil consumption had surpassed its domestic supply (Bauman and Petrock, 1981). This oil supply-demand situation in the United States had created a United States' dependence on imported oil. By 1974, the world crude oil prices had quadrupled (Weaver, 1981). Subsequently, in 1975 Congress passed the Energy Policy and Conservation Act which regulated domestic oil prices, fuel standards for automobiles, and other conservation needs (Weaver, 1981). In 1978, the United States tolerated another energy-related inconvenience when the Iranian revolution stopped the exportation of oil (Weaver, 1981). The United States would have been in dire trouble, but with the AEC's prediction in 1973 (Fowler, 1983) that 300 nuclear energy reactors would be producing approximately 40 percent of all the energy generating capacity by 1985, nuclear power had promised to produce an alternate energy source. Then the 1979 Three Mile Island incident terrified the citizenry, and a moratorium on nuclear power ensued. The nuclear power moratorium was another factor which contributed to the escalation of domestic and imported oil prices (Weaver, 1981). In 1980, the passage of the National Synthetic Fuels Act and the formation of the Synthetic Fuels Corporation accelerated the exploration of synthetic liquid and gaseous fuels from coal and oil (Fowler, 1983). Fowler (1983) advised that the temporary oil glut and high interest rates of 1982 have diminished the exploration of synthetic liquid and gaseous fuels. Also, Fowler (1983) reported that solar energy should provide 20 percent of the total U. S. energy needs by the year 2000. Yet he warned that the OPEC cartel still wielded overwhelming control in the petroleum marketplace. How has education responded to the energy crisis?

Duggan (1981) provided a brief scenario of energy education from its inception by the AEC in 1971 through the DOE Faculty Development Programs. In response to a Congressional mandate, the AEC sponsored nuclear energy programs for teachers and college faculty. The Energy Research and Development Administration (ERDA) absorbed the AEC. ERDA expanded the scope of energy education by focusing on all energy sources and technologies, by increasing teacher training programs, and by emphasizing curriculum development. In 1977, the DOE absorbed the ERDA, the Federal Energy Administration, and the Federal Power Administration. With this transition came a new direction for energy education. The emphasis switched to programs at community and junior colleges and teacher institutes. These efforts have produced the development of staff, of energy curricula, and of other energy resource materials.

Goals of Energy Education

Boyer (1977) concluded that the energy dilemma is not a temporary crisis but rather a lifelong problem. The results of the National Assessment of Educational Progress (NAEP) of young adults between the ages of 26 and 35 on energy attitude and knowledge questions revealed general energy illiteracy among that population (Holmes, 1978). Buethe (1979) indicated that energy education is poorly articulated and energy literacy is low even though energy education through institutes has increased. Bauman et al. (1981) reported that a 1980 DOE opinion poll found that sixty-five percent of the respondents considered the energy situation not grave, whereas other polls have indicated that in general people do not have an understanding of energy sources and supplies. Therefore, energy education is imperative.

However, although scientists, science educators, historians, politicians, economists, and sociologists have agreed that there is a need for energy education, a consensus on what energy education should focus, how it should be taught, where it should be taught, when it should be taught, and why it should be taught is lacking. Therefore, some sentiments on these questions were provided.

Agnes, Conrad, and Nash (1974) advised that students should learn the long-term ramifications of energy use from scientific, ecological, political, social, and psychological perspectives. Furthermore, they advocated that energy education should focus on the energy crisis, energy resources, energy uses, and the hidden costs of technology (i.e., psychological, social, economic, aesthetic, and moral).

Fowler (1975 and 1977) warned that energy education is complex, multidimensional, and urgent with biological, sociological, economic and environmental implications. Furthermore, Fowler (1977) and Duggan (1978) recommended that energy education should be practical, should reach all students of all ages, and should be part of the total existing curriculum. Greenwald and Hahn (1977) advised that educators have the responsibility to effectuate changes and attitudes in students and in the community toward energy use and energy sources. Also, they stressed the importance of energy education since the energy industry affects all of society. Duggan (1978) described energy education as the three C's: citizens, careers, and consumers. Energy education should inform students of the energy situation and the energy options so that they as citizens can make intelligent decisions. Also, energy education should inform students of energy related careers and of attitudes and lifestyles that can influence conservation. Boyer (1977) reported that energy education should help to change lifestyles and to cultivate new attitudes, values, and habits. Allen and LaHart (1979) emphasized the ethical, moral, and anthropological perspectives of energy education. Because of the complexity and implications of energy education, Gierke (1978) recommended an interdisciplinary approach. Since the energy crisis is both an international and a complex problem with political, economic, social, and moral implications, Eckenrod (1980) advocated the interdisciplinary approach to energy studies for the following reasons: social studies teachers can effectively teach the social, economic, political, and moral dimensions of energy; the science teacher can effectively teach the scientific and technical aspects of energy. Perry (1982) recommended an integrated approach with emphasis upon conservation and the environment. The Minnesota Energy Agency (1980) suggested an integrated approach for energy education because of its multifaceted perspectives. Horvat (1978) recommended that energy education be an interdisciplinary K-12 infusion curriculum focusing on the ecosystem and its relationship to energy; the environmental, societal, and political interactions of energy use; and the need for exploration of new energy sources.

Another focus of energy education is problem-solving and decision-making. Kuhn (1978 and 1979a) advised that energy education affects all strata of society; has social, political, and economic implications; is a continuous societal concern; involves both knowledge and attitudes; and should be a K-12 infusion approach in many disciplines. Also, he stressed the importance of decision-making. In addition, Petrock (1979) contended that since the schools are the victims of the energy crisis, they should take an active role in energy education and they should educate the youth to make intelligent decisions and to understand not only the scientific aspects of energy but also the political, social, ethical, and other implications of the energy dilemma. Furthermore, she advised that ample energy education materials were available, but direction in their use was needed. The Education Commission of the States (Petrock, 1979) recommended the following: schools should provide K-12 energy-related curriculum for all suitable courses, that agencies focusing on K-12 energy education should expand their intrastate efforts, that the states should develop energy education policies for allocation of funds for K-12 energy education curriculum, that the state and local education agencies and schools should find ways to gain increased federal support for energy education, and that boards should insure preservice and inservice energy education at institutions of higher learning. However, Schafer (1979) cautioned that all branches of environmental education, including energy education, should cooperate rather than compete for support and funds.

McLeod, Hetherington, and Treagust (1980) referred to the U.S.'s reaction to the energy crisis as an "energy ethic." This "energy ethic" demonstrated the need for conservation, the need to reduce consumption. It stressed the need to educate students so they can become effective policymakers.

Furthermore, the National School Boards Association (1980a) suggested that a group of K-12 volunteer teachers and curriculum leaders design a K-12 energy curriculum. It recommended that the group update energy-related materials, that counselors update energy-related career opportunity lists, that inservice workshops on energy be implemented, and that all school staff promote energy education.

Hofman and Miller (1979) described the topics and recommendations of the Second Annual Practitioners Conference on Energy Education, which consisted of teachers, curriculum experts, administrators, and representatives from industry and government. All K-12 teachers of all disciplines nationwide should participate in energy education inservice training. There should be a national clearinghouse to collect and distribute energy education information and materials. A complete annotated bibliography of energy education materials, which should include a description of the content and biases, should be published. Policy strategies of the federal government should formulate a steering committee on energy education. This committee would establish objectives for federal programs and review federal policies. The DOE, the U.S. Department of Education, and the NSF should continue to implement and support energy education. In each state, cooperatively the representatives of the governor's office, the legislature, the state energy office, the education agency and school board should formulate an energy education policy that would meet the state's needs. Each locale should develop energy education action plans. Energy education funding for the elderly, the disadvantaged, and the physically handicapped should be increased. These practitioners proposed that energy education should produce an energy-literate population which would be able to judge wise energy use and to make wise energy choices. Furthermore, they recommended that the energy education curricular materials should be more encompassing to include skills in communication, mathematics quantitative analysis, hypothesizing, and critical thinking. The practitioners listed the following accomplishments in energy education and urged continued support for these efforts: National Energy Education Day (NEED) established by President Carter; the support of energy education by DOE, the U.S. Department of Education, and NSF; the adoption of new state energy policies on energy education by fifteen states; and the abundance of curriculum materials on energy education.

The Third Annual Practitioners Conference on Energy Education (White et al., 1980) recommended the following strategies: an energy education network and clearinghouse; financial support for energy education beyond the DOE and the U.S. Department of Education; increased local support of energy education, particularly by school principals; political activism for energy education; and greater cooperation between schools and industries. In addition to these recommendations, this conference solicited support for these energy education programs: the DOE Faculty Development Program, the State Energy Education Policy, and the National Energy Education Day for which the National School Boards Association produced the Youth Awards Program for Energy Achievements (National School Boards Association, 1980b).

Bauman and Petrock (1981) outlined the "why, what, and how" of energy education. They recommended the following objectives of energy education: understanding of energy concepts, such as the fundamentals, sources, and needs; cognition of supply and demand trends; understanding the impact of energy sources locally, regionally, nationally, and internationally; knowledge of the energy scenario for wise and intelligent decision-making about the energy dilemma; and cognizance of the relationship between energy and careers. Furthermore, they recommended the following guidelines for effective implementation of energy education: cost-effective, interdisciplinary, infused, unbiased, relevant, and teacher preparatory/participatory approach.

The Fourth Annual Practitioners Conference on Energy Education (White, 1981) restated that energy is an ongoing concern, one which education, government, and industry should cooperatively address. This conference recommended that energy education materials should be adjuncts to the existing science and social studies textbooks; that local school boards should formulate guidelines for infusion of energy education into the existing K-12 social studies and science curricula, especially in the middle grades; that the local school boards should use the National Council of Social Studies' (NCSS) criteria for curricula selection; and that publishers should receive a sample packet of energy education materials from NCSS and NSTA.

Steinbrink and Jones (1981a) outlined objectives for effective energy education which included the impact of teacher education programs on the development of energy literate educators and the cooperation among industry, education, federal agencies, environmental organizations, and other groups. They advocated a "grass roots, curriculum infusion, and transdisciplinary" approach to energy education (Steinbrink et al., 1981a, p. 94).

"Network Names State Contacts" (1983) reported that two National Energy Education Network meetings, one in Connecticut and the other in Texas, were conducted during the fall of 1982. The Network meetings consisted of teachers, state government officials, and industry representatives. The delegations recommended the following needs of energy education: a definition of energy education and of energy literacy, a state energy committee to coordinate and articulate energy education curricula and activities, interstate energy networking, funding for regional and networking meetings, and a national committee to focus on broad energy issues.

Glass (1982a) delineated the features of a paradigmatic energy education program. These features included curricular and instructional materials congruous with the goals for energy literacy, for hierarchical affective and cognitive outcomes, for an interdisciplinary approach, and for articulation within a grade and between grades; and focusing on issues indigeneous to the community yet applicable to the national and international situation. Fowler (1983) concluded that science teachers should understand the energy dilemma and should impart the information to their students.

A Conceptual Framework for Energy Education, K-12, (Enterprise for Education, Inc., 1982) delineated the following goals for energy education. Students should understand the basic physical laws of energy and their impact on society and technology. Students should gain information about energy sources, uses, and management for wise decision-making. Also, the students should acquire the necessary technical information for decision-making. In addition, the students should learn that wise decision-making can produce desireable results. Finally, the students should incorporate the energy knowledge into their own lifestyles.

The "Directory of Energy Education Materials" (1983) has illustrated the range of available energy education materials designed for kindergarten through college level. Not only do the kinds of materials have various approaches and emphasis, but also the designers of the materials represent different agencies and professional organizations.

Energy Education Research

Energy education research has been completed on curricula effectiveness, on attitudes and knowledge of energy issues, on the effectiveness of energy education workshops, and on the articulation of energy education policy among the State Education Department, the Office of Energy Resources, the governor's office, and the legislature.

Jones and Steinbrink (1977) conducted a survey of State Education Departments of all fifty states. Only twenty states submitted energy education materials. After analyzing the materials, they recommended that interdisciplinary materials, explicit instructions for the materials, and activities that would involve values clarification, decision-making, and problem-solving be developed.

The Ohio Department of Education's Energy Assistance Office (Energy Assistance Office, 1981; Energy 80 Project, 1980) surveyed teachers throughout Ohio. Of the 1,670 responses, 43% were K-6 teachers; 56% were 7-12 teachers. The distribution of those teachers who responded was 22% science teachers, 17% language arts teachers, 17% mathematics teachers, 16% reading teachers, and 15% social studies teachers. Ninety-five percent agreed that energy education was necessary for the 1980s. They ranked their energy education needs as follows: student activities, films, and teacher inservice. They selected conservation and environmental issues as the most important topics.

Energy Information Associates, Inc. (1978) conducted a survey to determine the status of state energy education policy. Surveys were sent to the State Education Department, the Office of Energy Resources, the governor's office, and the legislature. This organization concluded that there was lack of communication and cooperation among departments, that the greatest communication was between the State Education Department and the State Energy Office on Energy Education, that the State Education Department and the State Energy Office assumed the greatest responsibility for energy education, that the State Energy Office with federal funds supported the most energy education, that the State Energy Office of many states was part of the governor's cabinet, and that most K-12 energy education programs were infusion units. These findings implied that there was little interest or support from state governmental agencies. Nevertheless, the study found that thirty-nine states had at least one staff person working on energy education in some capacity.

The Energy Education Task Force (EETF) (Maine Office of Energy Resources, 1981), which consisted of individuals from the public schools, UMO, the Office of Energy Resources (OER), environmental groups, utility companies, and State Department of Education and Cultural Services (DECS), conducted an energy education needs assessment of Maine teachers. Based upon the survey results, EETF made the following recommendations: (1) A comprehensive energy education program should be established. (2) OER, DECS, and UMO should direct the development of this program. (3) The Planning Committee should consist of OER, DESC, UMO, and representatives from schools and other educational organizations. (4) The Planning Committee should evaluate existing energy education curricula, develop an energy education framework, and adapt or develop a K-12 interdisciplinary energy education curriculum. (5) The survey results should serve as guidelines for the K-12 interdisciplinary curriculum. (6) The K-12 interdisciplinary energy education curriculum should be utilized in preservice and inservice teacher education. (7) Funding for this project should be sought.

Coon and Disinger (1979) surveyed twelve schools to determine what energy resources they had and how they used them. They concluded that these schools utilized materials produced on both the local and national levels and that the procedures for implementation of energy education materials were diverse. Also, they concluded that most projects were science and social studies and that the success of the program rested on the teacher.

Champagne and Klopfer (1977) established guidelines for the analysis and design of energy education materials. They proposed three decision-making criteria: the consumer of the energy education materials (purchaser), the allocator of funds (funders), and the developer of the materials (designers). They explicitly defined instructional materials and established and defined the nine components for instructional programs.

Kooi (1979) evaluated the twenty-one PEEC units. He examined the reading levels of the units, the scope of the energy content, the treatment of controversial issues, and their utilization of the multidisciplinary infusion approach to energy education. Based upon his findings, he made the following recommendations: (1) Adjust reading levels of units to the level assigned. (2) Evaluate the reading level before the material is published. (3) Include more materials on conservation. (4) Include more activities on physical laws. (5) Concentrate on areas other than sciences and social studies when new materials are developed. (6) Include more elementary materials. (7) Include activities on attitudes and values. (8) Include activities on growth perspective of future energy uses. (9) Update PEEC materials periodically. (10) Make materials uniform in their utilization of units of power, energy, and work.

Miller et al. (1979) reviewed and evaluated DOE energy education curriculum materials. They concluded that teachers were not using the materials widely because they were unaware of the availability of the materials, that teachers using the materials offered good evaluations, and that DOE materials' evaluation have concentrated on teachers' impressions rather on students'. They recommended that the impact of these energy education materials on students be studied, that the materials development staff be increased by two, and that the publicity and dissemination of materials be improved by including a perforated request card with every order and by setting up information booths at major education conferences.

Kuhn (1979b) examined the patterns of responses of 413 students, grades 10-12, on a 82-item Likert-type Energy Opinionnaire about energy-related matters. Statistically significant differences between the males and females were found. The males scored significantly higher than the females on the following attributes: background in chemistry, interest in science, and trying to keep informed on issues affecting our nation.

Moore (1981) administered an adaption of the Energy Inventory (Hickman, 1977) to four groups of college-age subjects to determine their energy related knowledge and their attitudes toward the energy issue. He concluded that third year and beyond science majors performed significantly better than first and second year science majors and all non-science majors on the knowledge section. Also, the first or second year science majors performed significantly higher than the first or second year non-science majors on the knowledge section.

Crater and Mears (1981) conducted a study of eighth grade earth science students in Mississippi. The experimental group used "Transportation and the City", a PEEC unit plus such activities as solar collectors, Celsius thermometer, and electric meter readings; the comparison group used an earth science textbook. They selected twenty-four statements to measure attitudes toward energy and twenty multiple-choice type questions to measure knowledge of energy from the NAEP. As expected, they found that the students who received the energy unit scored higher on the knowledge of energy test and had more positive conservation attitudes.

Glass and Hofman (1980) field-tested the PEEC unit "Coal" on 234 students in Iowa. The students reported that the unit encouraged them to think about energy concepts. The five teachers judged the materials as relevant for their local society.

Richardson and Johnson (1980) examined the attitudinal changes toward energy and related areas of workshop participants in four Texas universities. An 86-item Likert-type instrument was administered to 205 individuals in a graduate teacher education course. An 86x86 intercorrelation matrix resulted from the coefficients of correlation, and data was factor analyzed. The results of the t-test found statistically significant differences in group attitudes for the four groups who participated in similar workshops. They concluded that effectiveness studies of energy workshops were needed. They found that subject area, grade level, and sex were not statistically significant.

To determine whether boys and girls used the same words to describe the energy dilemma, Kielbowick (1982) conducted a study with 103 seventh graders between the ages of twelve and fourteen. Each student wrote a ten minute prose statement describing the energy dilemma. The results of the statistical analysis implied that boys and girls used different words to describe the energy dilemma.

To measure how teachers' attitudes toward the subject affects the implementation success of energy education, James (1982) administered Stages of Concern, which involves self, task, and impact, of the Concerns Based Adoption Model to DOE Faculty Development summer workshop participants. The findings of this study (i.e., self and task concerns increased more than impact concerns) supported the concerns theory. He concluded that these workshops should concentrate on impact concerns (effects of innovation).

Fazio and Dunlop (1977) used a 20-item multiple choice test Energy-Environment Quotient to assess energy-environmental facts of non-science college majors in two universities in western Pennsylvania. The 24 volunteers were pretested and given six lectures with presentations on the energy dilemma, energy concepts, U.S. energy sources, alternative sources, and the impact of energy use on the environment. The results of the correlated t-test were significant. The open-ended questions supported the need for Energy-Environment topics in science.

Koballa (1981) developed a Likert-type scale, consisting of egocentric, sociocentric, and action-centered statements, to measure attitudes toward energy conservation. The final 22 statements were both factor analyzed and rated on a Likert-type scale. He concluded that the results of the statistical analysis implied that the 22 statements could be utilized in the evaluation of treatment in attitudinal research.

Holden and Barrow (1982) developed and validated an instrument Test of Energy Concepts and Values (TECV) from the Energy Knowledge and Attitudes Test developed by NAEP. The TECV was administered to 392 students, grades 8-12. The students' teachers had participated in the DOE Faculty Development workshop at UMO during July, 1980. The results, commensurate with those of the NAEP, suggested that the TECV is a valid and reliable instrument for measuring attitudes and knowledge of energy of high school students.

The NAEP (1975) in two major science assessments of 9 year, 13 year, 17 year, and 26-35 year olds found a decline in science scores between 1969 and 1973 and concluded that energy concepts were a predominant concern.

Holmes (1978) reported the results of the 1978 NAEP survey of 1300 young adults between the ages of 26 and 35 on energy attitude and knowledge questions. The results of the knowledge questions indicated that only 49% of the young adults realized that coal is the largest fossil fuel reserve in the U.S., that only 14% of the young adults knew that coal produced the largest portion of our electrical energy, and that only 46% of the subjects realized that petroleum supplied the greatest percentage of energy consumed in the U.S. The attitudinal questions revealed that 95% of the subjects considered energy education necessary in the school curriculum. These findings suggested that energy education was needed.

Kohl (1981) reported the findings of a North Carolina 1978 summer workshop for teachers on utilization of available energy education materials. The workshop participants concluded that energy reference materials should be of three types: actual teaching materials, background materials, and handout materials.

In a study of the impact of inservice training of teachers on energy topics in Granite School District, Salt Lake City, Utah, Farnsworth and Gardiner (1978) developed a questionnaire to assess the level of energy instruction both before and after the inservice energy workshops. The questionnaire included questions on the teachers' perceived impact of students' behavior and attitude. The results of the questionnaire seemed to suggest a significant positive change of behavior and attitudes of both teachers and students after the workshops.

Dunlop and Fazio (1981) evaluated the effect of a one-day DOE sponsored workshop on K-8 science teachers' attitudes toward energy conservation and on the participants' perceived view of the impact of business and industry, government, and personal attitudes on energy conservation programs. A 24-item Likert-type scale was administered to the workshops participants before and after the four workshops. The correlated t-test indicated that the overall attitude change for all four groups (K-2, 3-4, 5-6, and 7-8) was significant.

Glass (1981) conducted a study to measure the impact of an NSF energy education workshop on 25 secondary school teachers. He used the Energy Inventory to assess pre, post, and post-post energy knowledge and attitudes. The significant positive results on the Energy Inventory confirmed the effectiveness of energy workshops.

Steinbrink and Jones (1981b) advised that energy education can continue without federal and state dollars. The University of Houston at Clear Lake City conducted two week-long Energy Curriculum Institutes for four summers, 1978-1981. These institutes were funded by Shell Companies Foundation, Inc. They found that institute success depended on the following: speakers working in the energy field, concentration on instruction and contract grading, and a balanced program (pros and cons of the issues). They concluded that energy education programs can produce energy literate educators; cooperation among all agencies, companies, and schools; and funding from local companies.

Barrow (1982) administered three instruments, the Energy Inventory, the Q-sort, and the Rotter Internal-External Locus of Control Scale to 38 teachers who were participants in the DOE Faculty Development summer energy education workshop during July, 1980, at UMO and to a group of graduate students. The results of this study suggested that energy education workshops were effective in increasing energy knowledge.

Riley and Waugh (1982) designed cognitive and affective scales from Book 4 of the NAEP (1978). The affective items used a Likert-type scale, whereas the cognitive items were true-false or multiple choice. Twenty-four inservice teachers who were enrolled in a DOE summer energy workshop took the cognitive and affective tests. Results of the independent and dependent t-tests indicated that the released NAEP energy items provide reliable (.65 to .86) and effective measures of energy knowledge and attitudes.

Glass (1982b) conducted a pretest-postest control group design study to measure the effect of a thirty weekly inservice session NSF sponsored energy education workshop for 27 elementary school teachers. He administered the Energy Inventory to the inservice workshop participants to measure the amount of change of energy knowledge and of energy attitudes. Each of the 27 workshop participants were to select a peer teacher for the control group. The selection was based on the following criteria: the teacher's educational major, degree or credit hours, and date of last education; years of teaching; grade level; sex; and similar beliefs and attitudes. He concluded that the closeness of pretest scores seemed to indicate that the subjects were well matched. The most significant change was on the knowledge subtest; the least change was on the attitude toward personal responsibility in energy-related matters.

Garey et al. (1980) assessed the DOE Faculty Development workshops of 1978 and 1979. They found that general and physical science teachers dominated the energy workshops; that the major reasons for attending the summer workshops were to learn more about energy resources and problems and to get ideas, materials, and information for their teaching of energy education; that participants rated the workshops high on content, presentation methods, provision for both sides of the issue, and a chance to interact with other participants and the instructors; that they rated field trips and faculty lectures as most valuable; and they indicated that use of the materials in teaching would be in the form of lectures, handouts, and laboratory activities. The implications of these results indicated that the objectives of the workshops were met. The 1979 workshop participants suggested a need for more formal/informal discussion/questioning with the instructors and other participants. The findings also seemed to indicate a desire for traditional teaching approaches. The overall administrative support was high.

Preston-Anderson (1982) reported the findings of the assessment of the 1981 DOE Faculty Development summer energy education workshops. Six hundred sixty-four participants of the 2080 participants were evaluated. The intent of the 1981 workshops was to inform, train and motivate teachers to teach energy concepts in the nation's schools so that the students would become energy literate for their roles as citizens, consumers, and careers and that communication and cooperation continue between teachers and educational institutions that offer energy education. The objective dealing with effective implementation of energy education into the classroom was measured only by what the participants indicated they intended to do. Preston-Anderson concluded that the results supported the continuation of DOE summer energy workshops.

Landes (1981) examined the relationship between the amount of time the teachers spent on energy education teaching in their classrooms after participation in an energy education inservice workshop and the teacher characteristics and specific inservice workshop factors. The results seemed to indicate that previous attendance at energy education workshops had a significant positive effect upon the teachers' decision to teach energy and that teachers who participated in a total group (K-8) workshop taught significantly more energy education than those who participated in the split group (K-4, 5-8) workshop.

White et al. (1983) reported the results of the PEEC's Survey of the Current Status of Energy Education. This survey which was mailed randomly to 7,000 elementary and secondary teachers and principals received a 20% return rate. The findings indicated that 58% of the elementary teachers and 52% of the secondary teachers taught energy. Also, 66% of those who taught energy utilized the infusion or integrated approach (not a whole unit). Likewise, teachers, and principals most frequently recommended the infusion or integrated approach. The teachers indicated that they emphasized the following energy topics: conservation, conventional energy resources, renewable energy resources, and energy and environmental interactions. In addition to the above energy topics, secondary science teachers also stressed the scientific concepts of energy. The principals concurred with the teachers. Teachers indicated that they created more than 60% of their supplementary teaching materials. Furthermore, 65% of the elementary and 64% of the secondary teachers concluded that the textbook coverage of energy was inadequate. Student knowledge and student awareness of energy issues were ranked low. Eighty-nine percent of the elementary principals and 94% of the secondary principals concurred that energy should be part of the school curriculum. The reason most often given for teaching energy education was personal conviction. The reason most often cited for not teaching energy education was that energy was not a curriculum basic. Although principals suggested that teachers did not teach energy education because the teachers did not feel qualified, the teachers identified the principals' lack of support (68% for elementary teachers and 83% for secondary teachers) as a major reason for not teaching energy education.

Barrow et al. (1983) utilized the Energy Inventory to examine the energy knowledge and attitudes of the 1981 DOE energy education workshop participants at UMO. They found statistically significant gains in the knowledge subscale and use of energy items on the Energy Inventory. In addition, statistically significant differences in favor of the science teachers were found for the energy items and the knowledge subscale. The comparison of 1981 DOE participants with the 1980 DOE participants at UMO indicated statistically significant differences on the energy resource items and attitude subscale in favor of the 1981 participants.

Impact Studies

Hounshell and Liggett (1976) conducted a study to measure the impact of inservice workshops in environmental education on teachers, the primary treatment group, and their students, the secondary treatment group. They used the Environmental Knowledge and Opinion Survey to measure the knowledge and attitudes of these sixth grade students. The positive results supported the need for inservice teacher education in environmental education.

Richardson et al. (1980) suggested that although energy workshops have been conducted, little effort has been invested in effectiveness studies. They used a Likert-type scale to measure attitudinal changes of participants in four energy workshops. They found that subject area, grade level, and sex were not statistically significant. They recommended impact studies on energy workshops.

Murphy and Dahlin (1978) investigated the impact of the Zero Population Growth Population Education Program's five workshops on the participant teachers during 1975 and 1976. First, a questionnaire was completed, then a telephone survey to validate the questionnaire was implemented. The results of the questionnaire were used to improve the curriculum materials of Zero Population Growth Population Education Program.

In a study on the relationship between teacher participation in NSF Institutes and student achievement in senior high mathematics and science, Willson and Garibaldi (1976) found that NSF participants' students did significantly better than students of other teachers. The study also indicated upward mobility of the participants as a result of the NSF Institutes. The findings seemed to suggest that the NSF institutes and workshops were effective.

Pearl (1974) advised that behavioral objectives and scales to measure goals are needed. Also, he argued that measurement procedures are essential for the development of sound educational theory which can serve as a base for general science education.

Kastrinos (1967) studied 46 summer institute participants to determine the impact of the institute on their educational endeavors. The findings indicated that participation in the institute had a significant impact on the participants since 85% were still involved in the same field of science.

Ost (1971) measured the achievement of the objectives of a Secondary-School Biology Teachers Workshop. A pre-post correlated t-test was computed. He examined the institute participants' students' preference for biology, the participants' teaching behavior, the participants' techniques and skills in science, and the attitudes of the participants toward BSCS materials. The results seemed to indicate that participation in such an institute can change behavior and attitudes of teachers.

Highwood et al. (1972) investigated the impact of the Ball State University NSF summer institutes, 1966-1970, on the participants. Their primary concern was accountability since they advised that allocation of monies is commensurate with evidence of the program's success. The questionnaire focused on the utility of the workshops, career choice, advanced degrees, professional growth, and the workshop course effectiveness. The participants actually rated the individual laboratory experiments. The institutes had a positive significant effect.

Welch et al. (1973) developed a strategy for assessing the Comprehensive Program for Teacher Education by NSF. They concluded that an impact study has three purposes: decision making, ongoing planning, and evaluation.

Welch (1979) in an assessment study of the Comprehensive Teacher Training Program had principals and science and math teachers complete a questionnaire and goal rank procedures for secondary education. He found that teacher characteristics and participation in institutes affect students in a positive way. Although the principals and teachers did not agree on all the assessment needs, they corroborated on these three aspects: self-development, basic skills, and decision-making for secondary education.

Landes (1981) investigated the relationship between the amount of time the teachers spent on energy teaching in their classrooms after participation in an energy education inservice workshop and the teacher characteristics and specific inservice workshop factors. She utilized two written questionnaires (before-after inservice workshops) which were mailed to 215 teachers and personal interviews. The dependent variables were the number of lessons and the number of minutes taught using the energy education unit, MBTU (More: Better Than Usual). The independent variables included both workshop factors and teacher characteristics. The workshop factors consisted of length of workshop, type of workshop, number of teachers attending the workshop, principal's attendance and number of teachers from the same school and grade. The teacher characteristics included grade level, previous energy education teaching, teacher's perception of the importance of energy education, years of teaching, previous energy education workshop attendance, and voluntary versus required workshop attendance. The data were analyzed using Chi-square, t-test, Pearson product-moment correlations, analysis of variance, and discriminant analysis. The results of the statistical analysis seemed to suggest that previous attendance at energy education workshops had a significant effect upon the teachers' decision to teach energy and that teachers who participated in a total group (K-8) workshop taught significantly more energy education than those who participated in the split group (K-4, 5-8) workshop. The discriminant analysis revealed that there was no significant difference between high users and non-users of the MBTU curriculum materials and between users and non-users of the MBTU curriculum materials on any measureable characteristics. Another important finding was that principals' attendance at the inservice energy education workshop did not have a significant effect on the teaching of energy education. The reasons most frequently mentioned for the teaching of energy education were teachers' personal interest in energy education, the effect of the inservice energy education workshop, and the MBTU curriculum materials.

The cited related research has supported inservice education for teachers and administrators, but the criteria for effective inservice education has not been described. Inservice education has many goals and approaches. "Inservice Education," (1983) explicated the need for effective inservice education and the goals of inservice education. It was concluded that inservice education should be longer than one day if significant and lasting change is the goal. This research indicated that successful inservice programs had certain characteristics. First, teachers were actively involved in all aspects of the inservice program. Second, the diverse and exemplary programs were designed to meet the total staff needs. Third, the programs were scheduled at convenient times. Fourth, when facilitative for the inservice goals the programs were conducted at the school. Also, the principal's role in the inservice program and in the daily school activities was emphasized.

Furthermore, the research on effective teaching and school effectiveness supports the need for effective inservice education for teachers and administrators. Forte (1983) insisted that teachers should possess a repertoire of behaviors or techniques (i.e., knowledge of learning theories or the models of teaching), should understand the importance of different teaching and learning modalities, should realize that their role as a teacher is important, and should have equal expectations for all students.

Edmonds (1982a, 1982b) delineated five characteristics of an effective school. First, the principal is the instructional leader who focuses on quality education. Second, those involved in the school process understand the instructional focus and goals. Third, the school atmosphere is orderly and conducive to learning and teaching. Fourth, the teachers have equal expectations for all students. Fifth, student achievement is the basis for program effectiveness. These characteristics are important considerations for preservice and inservice program development.

Impact study research is needed to assess the effectiveness of preservice and inservice education for teachers and administrators, to formulate criteria and goals for effective preservice and inservice education for teachers and administrators, and to measure the cost-effectiveness of preservice and inservice education for administrators and teachers. Both history and maturation can affect the results of this type of research; nevertheless, impact studies are an effective means for measuring long-term effects. The impact studies reviewed supported the need for inservice education for teachers and administrators.

Summary

The related literature indicated there is a need for an impact study to measure the effectiveness of DOE Faculty Development summer energy education workshops and illustrated the design and use of impact study research.

CHAPTER III

METHODS AND PROCEDURES

This study focused on the impact of the DOE Faculty Development summer energy education workshops, conducted during the summers of 1980 and of 1981 at UMO, on the DOE participants and the impact of the local inservice energy education workshops, conducted by the DOE participants, on the DOE participants' peer teachers.

Chapter III includes a description of the population and of the setting, the instrumentation, the administration of the instruments, a description of the sample, and the statistical analysis procedure.

Population and Setting

Although the primary treatment group consisted of the 67 DOE participants in the 1980 and the 1981 DOE Faculty Development summer energy education workshops at UMO, this study included only 66 DOE participants since one of the 1981 DOE participants had left the state without a forwarding address. Therefore, the secondary treatment group consisted of 66 peer teachers, one selected by each DOE participant.

The DOE Faculty Development summer energy education workshops conducted at UMO included 38 participants, 8 female and 30 male, during the summer of 1980 and 29 participants, 6 female and 23 male, during the summer of 1981. The 67 DOE participants were Maine teachers and energy resource personnel who applied for and were selected to participate in the UMO summer energy education workshops. The 1980 DOE participants, consisting of 20 high school, 17 middle/junior high school, and 1 elementary school teachers, included the following disciplines: 11 biology and environmental sciences, 11 chemistry and physical sciences, 3 earth sciences, 6 industrial arts and home economics, and 7 social studies teachers, whereas the 1981 DOE participants, consisting of 15 high school, 13 middle/junior high school, and 1 elementary school teachers, included these disciplines: 4 biology and environmental sciences, 15 chemistry and physical sciences, 4 industrial arts and home economics, and 6 social studies teachers (see Appendix B for demographic information about the 67 DOE participants).

Although the duration of the 1980 UMO workshop was thirteen days and the duration of the 1981 UMO workshop was eleven days, the actual workshop time differed only by several hours. Therefore, both the 1980 and the 1981 participants received six credit hours (3 credit hours for the summer workshop participation and 3 credit hours for the fall-winter follow-up work) for completing the workshop requirements. Also, both workshops utilized professors from the Colleges of Education and of Engineering and Science at UMO. Although the energy topics for both the 1980 and the 1981 workshops were similar, there was a slight variation in emphasis. The 1980 UMO workshop emphasized the scientific, technological, and economic aspects of wood, solar, hydroelectric, nuclear energy and natural gas in Maine as alternate energy sources. The 1981 UMO workshop concentrated on the scientific, technological, and economic aspects of wood, solar, hydroelectric, nuclear energy and natural gas in Maine as energy sources without the emphasis on their being alternates. The 1980 and the 1981 UMO workshops had both similar and dissimilar requirements. The 1980 DOE participants' workshop requirements consisted of developing teacher background information and student activities for inclusion in the draft edition of the ABC's of Energy (Barrow and Hodgdon, 1981) and development and teaching of an energy education unit. The 1981 DOE participants' workshop requirments included revision of the ABC's of Energy (Barrow et al., 1981), the development of additional student activities for the final copy of the ABC's of Energy (Barrow and Bitner, 1982), and adapting and presenting of a PEEC unit to other DOE participants. Both the 1980 and the 1981 DOE participants helped to formulate and to direct a fall follow-up energy education conference. In addition, each DOE participant was responsible for conducting a local inservice energy education workshop which was designed by the DOE participants. The primary purpose of these local inservice energy education workshops was the dissemination of energy education information. These workshops consisted of displays, fairs, resource speakers, forums, and other activities on energy.

Instrumentation

This study utilized two mail survey instruments, the Energy Education Survey for Participants (EESP) and the Energy Education Survey for Peer Teachers (EESPT), both modifications of the Survey of the Current Status of Energy Education, the PEEC survey of 1982. The PEEC survey was modified according to Berty's (1979) guidelines for mail surveys with the primary focus upon the information needed for the study, followed by other important factors such as length of the survey, clarity, succinctness, and organization.

To evaluate the clarity of the instruments, the two surveys in draft form were administered to a group of public school teachers enrolled in a graduate science education methods course at UMO. Both their written and verbal responses and criticisms were utilized to revise and refine the two surveys. Furthermore, a language arts expert reviewed the two revised surveys for clarity, and the recommendations were incorporated in the final surveys.

Both survey instruments consisted of four sections: Prior Practices Related to Energy Education, Current Practices Related to Energy Education, Factors Influencing the Teaching of Energy Education, and Background Information. Each survey question provided explicit directions for its completion (see Appendix C for the survey instruments).

The cover letter included a statement of the purpose of the study; requested return date; an assurance of confidentiality; a request to complete the surveys; the name, address, and telephone numbers of the researcher; and a form request for the research results. The DOE participants' cover letter also delineated the criteria for selecting the peer teachers (see Appendix C for the cover letters).

Administration of the Instruments

The two survey instruments, EESP and EESPT, with the appropriate cover letters and two stamped self-addressed envelopes were mailed to each of the 67 DOE participants on October 25, 1982. The DOE participants' cover letter instructed the DOE participant to complete and return the EESP by November 22, 1982 and to select a peer teacher to complete and return the EESPT by November 22, 1982. If the DOE participant had changed school or was not teaching, he/she was instructed to return the uncompleted EESPT. The first mailing based on the 67 DOE participants, produced a 46% return rate for the DOE participants and a 34% return rate for the peer teachers (Table 1). On November 23, 1982, the second mailing to the 36 nonrespondent DOE participants which consisted of the appropriate surveys, cover letters with a requested return date of December 10, 1982, and stamped self-addressed envelopes was completed. The second mailing increased the response rate of the DOE participants to 63% and that of the peer teachers to 46%. Also, at that time, the researcher was informed that one DOE participant had left the state without a forwarding address; therefore, the total number of DOE participants was reduced to 66. Subsequently, the researcher made follow-up telephone calls to the 24 nonrespondent DOE participants on December 15, 1982. January 10, 1983 was established as the final deadline for receipt of the surveys. The follow-up telephone calls increased the DOE participants' survey return rate to 76% and the peer teachers' survey return rate to 60% with a total response rate of 68%. Since only completed surveys were utilized in this study, the final usable surveys consisted of 50 DOE participants (75% return rate) and 29 peer teachers (43% return rate). The one DOE participant who responded, but who did not complete the EESP informed the researcher that energy education no longer was included in his school curriculum. Since the DOE participants were instructed to return the EESPT if they had changed schools or were not teaching during 1982-1983, there was a disparity between the final return rate of the EESPT (40 or 60%) and the final usable EESPTs (29 or 43%). Therefore, the total sample consisted of 79 subjects (59%).

TABLE 1

EESP and EESPT Survey Return Rate

	Total Possible	After First Mailing		After Second Mailing		After Telephone Follow up		Final Usable Surveys	
	N	N	%	N	%	N	%	N	%
1980 DOE	38	21	55	28	74	28	74	28	74
1981 DOE	29[a]	10	34	14	48	23	79	22	76
DOE Total	67[b]	31	46	42	63	51[c]	76	50	75
1980 Peer	38	13	34	18	47	19	50	15	40
1981 Peer	29[a]	10	34	13	45	21[d]	72	14	48
Peer Total	67[b]	23	34	31	46	40	60	29	43
DOE and Peer Total	134	53	40	73	54	91	68	79	59

[a] consisted of 28 after first mailing

[b] consisted of 66 after first mailing

[c] one survey returned uncompleted

[d] seven surveys returned uncompleted

Sample

The sample consisted of 79 subjects, 50 DOE participants and 29 peer teachers, who returned completed surveys. The subjects were categorized by school type (i.e., elementary, middle/junior high, senior high, or non-teaching) (Table 2). Moreover, the middle/junior high and senior high subjects were grouped by subject taught (i.e., science, social studies, industrial arts, or other). The twenty-eight 1980 DOE participants consisted of one elementary school teacher, four middle/ junior high school teachers (2 science and 1 other), twenty-one senior high school teachers (11 science, 5 social studies, 3 industrial arts, and 2 other), and two non-teaching personnel. The fifteen 1980 peer teachers consisted of one elementary school teacher, four middle/junior high school teachers (2 science, 1 social studies, and 1 other), and ten senior high school teachers (4 science, 2 social studies, 1 industrial arts, and 3 other). The twenty-two 1981 DOE participants consisted of twelve middle/ junior high school teachers (7 science and 5 social studies), seven senior high school teachers (5 science, 1 social studies, and 1 industrial arts), and three non-teaching personnel. The fourteen 1981 peer teachers consisted of one elementary school teacher, six middle/junior high school teachers (2 science, 1 social studies, and 3 other), and seven senior high school teachers (3 science, 1 social studies, 2 industrial arts, and 1 other). Additional demographic information about the 50 DOE participants and about the 29 peer teachers is included in Tables 3, 4, and 5.

TABLE 2

Frequency Distribution of the 79 Survey Respondents' School Type and Subject Taught During the 1982-1983 School Year

	1980 Respondents				1981 Respondents			
	Participants		Peers		Participants		Peers	
Variable Label	n	%	n	%	n	%	n	%
Elementary	1	3.6	1	6.7	0	0.0	1	7.1
Middle/Jr.H.	4	14.3	4	26.7	12	54.5	6	42.9
Science	3	10.7	2	13.3	7	31.8	2	14.3
Social Studies	0	0.0	1	6.7	5	22.7	1	7.1
Industrial Arts	0	0.0	0	0.0	0	0.0	0	0.0
Other	1	3.6	1	6.7	0.	0.0	3	21.4
Senior High	21	75.0	10	66.7	7	31.8	7	50.0
Science	11	39.3	4	26.7	5	22.7	3	21.4
Social Studies	5	17.9	2	13.3	1	4.5	1	7.1
Industrial Arts	3	10.7	1	6.7	1	4.5	2	14.3
Other	2	7.1	3	20.0	0	0.0	1	7.1
Energy Resource Non-teaching Personnel	2	7.1	0	0.0	3	13.6	0	0.0
N	1980=43				1981=36			

TABLE 3

Frequency Distribution of
Demographic Information About the 50 DOE
Participant Respondents and the 29 Peer Teacher Respondents

	Participants		Peers	
Variable Label	n	%	n	%
Highest Degree				
Associate				
1980	1	3.6	0	0.0
1981	1	4.5	0	0.0
Total	2	4.0	0	0.0
Bachelor				
1980	11	39.3	7	46.7
1981	12	54.5	5	35.7
Total	23	46.0	12	41.4
Master				
1980	10	35.1	6	40.0
1981	8	36.4	8	57.1
Total	18	36.0	14	48.3
CAS				
1980	6	21.4	2	13.3
1981	1	4.5	1	7.1
Total	7	14.0	3	10.3
Last Degree Received				
Less than 5 years ago				
1980	10	35.8	1	6.7
1981	3	13.5	5	35.6
Total	13	26.0	6	20.6
5-10 years ago				
1980	8	28.6	8	53.3
1981	6	27.1	3	21.3
Total	14	28.0	11	37.9
11-15 years ago				
1980	4	14.3	6	40.1
1981	6	27.1	4	28.4
Total	10	20.0	10	34.5

TABLE 3 (Cont.)

Frequency Distribution of Demographic Information About the 50 DOE Participant Respondents and the 29 Peer Teacher Respondents

	Participants		Peers	
Variable Label	n	%	n	%
16-20 years ago				
1980	2	7.2	0	0.0
1981	5	22.6	2	14.2
Total	7	14.0	2	6.8
21+ years ago				
1980	3	10.8	0	0.0
1981	2	9.0	0	0.0
Total	5	10.0	0	0.0
No response				
1980	1	3.6	0	0.0
1981	0	0.0	0	0.0
Total	1	2.0	0	0.0
Total years of teaching				
Less than 5 years				
1980	1	3.6	2	13.3
1981	3	13.6	0	0.0
Total			2	6.0
5-10 years				
1980	11	32.3	6	40.1
1981	4	18.1	5	35.7
Total	15	30.0	11	37.1
11-15 years				
1980	6	21.4	2	13.4
1981	5	22.6	4	28.5
Total	11	22.0	6	20.6
16-20 years				
1980	6	21.5	3	20.1
1981	5	22.7	2	14.2
Total	11	22.0	5	17.1

TABLE 3 (Cont.)

Frequency Distribution of
Demographic Information About the 50 DOE
Participant Respondents and the 29 Peer Teacher Respondents

	Participants		Peers	
Variable Label	n	%	n	%
21+ years				
1980	4	14.4	2	13.3
1981	5	22.6	3	21.4
Total	9	18.0	5	17.2
	Range	3-34 years	3-24 years	
	Mean	13.740	12.931	
	S.D.	7.096	6.458	
Years of Teaching in Present School				
Less than 5 years				
1980	4	14.3	4	26.7
1981	9	40.8	3	21.4
Total	13	26.0	7	24.0
5-10 years				
1980	12	42.9	5	33.4
1981	2	9.0	5	35.6
Total	14	28.0	10	34.3
11-15 years				
1980	5	17.9	4	26.7
1981	6	27.2	2	14.2
Total	11	22.0	6	20.6
16-20 years				
1980	4	14.4	1	6.7
1981	3	13.5	3	21.3
Total	7	14.0	4	13.7
21+ years				
1980	3	10.8	1	6.7
1981	2	9.0	1	7.1
Total	5	10.0	2	6.9

TABLE 3 (Cont.)

Frequency Distribution of
Demographic Information About the 50 DOE
Participant Respondents and the 29 Peer Teacher Respondents

	Participants		Peers	
Variable Label	n	%	n	%
	Range	0-34 years	2-23 years	
	Mean	10.620	10.483	
	S.D.	7.309	6.534	
Years of Teaching Energy Education				
Less than 5 years				
1980	22	78.6	11	73.3
1981	16	72.7	11	78.5
Total	38	76.0	22	75.8
5-10 years				
1980	6	21.4	3	20.0
1981	5	22.6	1	7.1
Total	11	22.0	4	13.7
11+ years				
1980	0	0.0	1	6.7
1981	1	4.5	2	14.2
Total	1	2.0	3	10.2
	Range	0-21 years	0-19 years	
	Mean	4.000	3.828	
	S.D.	3.399	5.258	
Gender				
Male				
1980	23	82.1	15	100.0
1981	17	77.3	11	78.6
Total	40	80.0	26	89.7
Female				
1980	5	17.9	0	0.0
1981	5	22.7	3	21.4
Total	10	20.0	3	10.3

TABLE 3 (Cont.)

Frequency Distribution of Demographic Information About the 50 DOE Participant Respondents and the 29 Peer Teacher Respondents

	Participants		Peers	
Variable Label	n	%	n	%
Age				
20-30 years				
1980	2	7.1	4	26.7
1981	5	22.7	1	7.1
Total	7	14.0	5	17.2
31-40 years				
1980	14	50.0	6	40.0
1981	8	36.4	6	42.9
Total	22	44.0	12	41.4
41-50 years				
1980	10	35.7	5	33.3
1981	8	36.4	3	21.4
Total	18	36.0	8	27.6
51-60 years				
1980	1	3.6	0	0.0
1981	1	4.5	3	21.4
Total	2	4.0	3	10.3
61+ years				
1980	1	3.6	0	0.0
1981	0	0.0	1	7.1
Total	1	2.0	1	3.4
Grades Teaching during 1982-1983				
Below sixth grade				
1980	2	7.1	0	0.0
1981	0	0.0	0	0.0
Total	2	4.0	0	0.0
Sixth grade				
1980	2	7.1	2	13.3
1981	1	4.5	0	0.0
Total	3	6.0	2	6.9

TABLE 3 (Cont.)

Frequency Distribution of Demogragphic Information About the 50 DOE Participant Respondents and the 29 Peer Teacher Respondents

	Participants		Peers	
Variable Label	n	%	n	%
Seventh grade				
1980	6	21.4	4	26.7
1981	8	36.4	4	28.6
Total	14	28.0	8	27.6
Eighth grade				
1980	6	21.4	4	26.7
1981	11	50.0	5	35.7
Total	17	34.0	9	31.0
Ninth grade				
1980	15	53.6	6	40.0
1981	2	9.1	3	21.4
Total	17	34.0	9	31.0
Tenth grade				
1980	15	53.6	6	40.0
1981	4	18.2	4	28.6
Total	19	38.0	10	34.5
Eleventh grade				
1980	18	64.3	6	40.0
1981	5	22.7	4	28.6
Total	23	46.0	10	34.5
Twelfth grade				
1980	19	67.9	5	33.3
1981	7	31.8	5	35.7
Total	26	52.0	10	34.5
School type during 1982-1983				
Elementary				
1980	1	3.6	1	6.7
1981	0	0.0	1	7.1
Total	1	2.0	2	6.9

TABLE 3 (Cont.)

Frequency Distribution of Demographic Information About the 50 DOE Participant Respondent and the 29 Peer Teacher Respondents

	Participants		Peers	
Variable Label	n	%	n	%
Middle/Junior				
1980	4	14.3	4	26.7
1981	12	54.5	6	42.9
Total	16	32.0	10	34.5
Secondary				
1980	21	75.0	10	66.7
1981	7	31.8	7	50.0
Total	28	56.0	17	58.6
Not teaching				
1980	2	7.1	0	0.0
1981	3	13.6	0	0.0
Total	5	10.0	0	0.0
Subjects taught				
Science				
1980	14	50.0	6	40.0
1981	12	54.5	5	35.7
Total	26	52.0	11	37.9
Social Studies				
1980	5	17.9	3	20.0
1981	6	27.3	2	14.3
Total	11	22.0	5	17.2
Industrial Arts or Home Economics				
1980	3	10.7	1	6.7
1981	1	4.5	2	14.3
Total	4	8.0	3	10.3
Science/Elementary				
1980	1	3.6	1	6.7
1981	0	0.0	1	7.1
Total	1	2.0	2	6.9

TABLE 3 (Cont.)

Frequency Distribution of Demographic Information About the 50 DOE Participant Respondents and the 29 Peer Teacher Respondents

	Participants		Peers	
Variable Label	n	%	n	%
Other				
1980	3	10.7	4	26.7
1981	0	0.0	3	28.6
Total	3	6.0	8	27.6
None				
1980	2	7.1	0	0.0
1981	3	13.6	0	0.0
Total	5	10.0	0	0.0
Subject by Science/Non-Science				
Science				
1980	15	53.6	7	46.7
1981	12	54.5	5	35.7
Total	27	54.0	12	41.4
Non-Science				
1980	11	39.3	8	53.3
1981	7	31.8	9	64.3
Total	18	36.0	17	58.6
None				
1980	2	7.1	0	0.0
1981	3	13.6	0	0.0
Total	5	10.0	0	0.0

TABLE 4

The 50 DOE Participants' Primary and Supplemental Heating Sources

	Primary Source		Supplemental Source	
Variable Label	n	%	n	%
Oil				
1980	8	28.6	11	39.3
1981	8	36.4	9	40.9
Total	16	32.0	20	40.0
Natural gas				
1980	0	0.0	0	0.0
1981	1	4.5	1	4.5
Total	1	2.0	1	2.0
Active solar system				
1980	1	3.6	1	3.6
1981	0	0.0	1	4.5
Total	1	2.0	2	4.0
Wood				
1980	16	57.1	3	10.7
1981	12	54.5	3	13.6
Total	28	56.0	6	12.0
Coal				
1980	1	3.6	1	3.6
1981	0	0.0	2	9.1
Total	1	2.0	3	6.0
Passive solar system				
1980	1	3.6	4	14.3
1981	0	0.0	3	13.6
Total	1	2.0	7	14.0
Electric				
1980	1	3.6	5	17.9
1981	1	4.5	3	13.6
Total	2	4.0	8	16.0
Kerosene				
1980	0	0.0	1	3.6
1981	0	0.0	0	0.0
Total	0	0.0	1	2.0
Other				
1980	0	0.0	1	3.6
1981	0	0.0	1	4.5
Total	0	0.0	2	2.0
None				
1980	0	0.0	6	21.4
1981	0	0.0	4	18.2
Total	0	0.0	10	20.0

TABLE 5

The 29 Peer Teachers' Primary and Supplemental Heating Sources

	Primary Source		Supplemental Source	
Variable Label	n	%	n	%
Oil				
1980	5	33.3	4	26.7
1981	7	50.0	3	21.4
Total	12	41.1	7	24.1
Natural gas				
1980	2	13.3	0	0.0
1981	1	7.1	0	0.0
Total	3	10.3	0	0.0
Active solar system				
1980	1	6.7	0	0.0
1981	0	0.0	0	0.0
Total	1	3.4	0	0.0
Wood				
1980	5	33.3	5	33.3
1981	4	28.6	4	28.6
Total	9	31.0	9	31.0
Coal				
1980	2	13.0	2	13.3
1981	0	0.0	0	0.0
Total	2	6.9	2	6.9
Passive solar system				
1980	0	0.0	0	0.0
1981	0	0.0	0	0.0
Total	0	0.0	0	0.0
Electric				
1980	0	0.0	1	6.7
1981	2	14.3	4	28.6
Total	2	6.9	5	17.2
Kerosene				
1980	0	0.0	0	0.0
1981	0	0.0	0	0.0
Total	0	0.0	0	0.0
Other				
1980	0	0.0	0	0.0
1981	0	0.0	0	0.0
Total	0	0.0	0	0.0
None				
1980	0	0.0	4	26.7
1981	0	0.0	3	21.4
Total	0	0.0	7	24.1

In addition to the above demographic information, the DOE participants completed questions relating to the student enrollment (see Appendix D), the number of teachers employed (see Appendix E), and the grades in their schools (see Appendix F). Also, the DOE participants described the approaches utilized by their schools for incorporating energy education into the school curriculum (see Appendix G).

Statistical Analysis

The statistical analysis was completed by the Computing and Data Processing Services at the University of Maine at Orono. Statistical subprograms from the Statistical Package for Social Sciences (SPSS), Second Edition (Nie, Hull, Jenkins, Steinbrenner, and Bent, 1975), the New Procedures and Facilities for Releases 7-9 (Hull and Nie, 1981), the Statistical Package for Social Sciences (Norusis, 1982), SAS User's Guide: Basics, 1982 Edition (Ray, 1982), and SAS User's Guide: Statistics, 1982 Edition (Ray, 1982) were utilized to analyze the data.

The hypothesis number, survey source, variable description, comparison, and statistic were delineated in Figures 1 through 4.

All data were reported at or beyond the .05 level of significance.

Summary

Chapter III explicated the population and setting, the instrumentation, the administration of the instruments, the sample, and the statistical analysis procedure.

Figure 1

Research Question 1

Hypothesis Number	Variable Description	Survey Source	Comparison	Statistic
1.1.	prior energy education experiences	EESP-A1	1980 DOE vs 1981 DOE	χ^2
1.2.	prior energy education experiences	EESPT-A2	1980 Peer vs 1981 Peer	χ^2
1.3.	prior energy education topics	EESP-A3	1980 DOE vs 1981 DOE	χ^2
1.4.	prior energy education topics	EESPT-A3	1980 Peer vs 1981 Peer	χ^2
1.5.	kinds of curricular materials utilized in energy education	EESP-B7	1980 DOE vs 1981 DOE	χ^2
1.6.	kinds of curricular materials utilized in energy education	EESPT-B6	1980 Peer vs 1981 Peer	χ^2
1.7.	factors influencing the teaching of energy education	EESP-C1 through EESP-C10	1980 DOE vs 1981 DOE	χ^2
1.8.	factors influencing the teaching of energy education	EESPT-C1 through EESPT-C8	1980 Peer vs 1981 Peer	χ^2

Figure 2

Research Question 2

Hypothesis Number	Variable Description	Survey Source	Comparison	Statistic
2.1.	energy education topics in 1982-1983 school curriculum	EESP-B6	1980 DOE vs 1981 DOE	χ^2
2.2.	recommended procedure for energy education/curricular design	EESP-B1 and EESP-B3	procedure with design	Spearman Rank
2.3.	energy topics before/after UMO workshop	EESP-A3 EESP-B6 EESP-D86	science/ non-science	χ^2
2.4.	students' energy conservation practices/ knowledge of energy-related topics	EESP-B4a EESP-B4b EESP-D8b	science vs non-science	χ^2
2.5.	energy definition and factors influencing the teaching of energy education	EESP-B5 EESP-C1 through C10	definition, factors	Spearman Rank

Figure 3

Research Question 3

Hypothesis Number	Variable Description	Survey Source	Comparison	Statistic
3.1.	energy education topics in 1982-1983 school curriculum	EESPT-B5	1980 Peer vs 1981 Peer	χ^2
3.2.	recommended procedures for energy education curricular design	EESPT-B1 EESPT-B2	procedure with design	Spearman Rank
3.3.	energy topics before/after UMO workshop	EESPT-A3 EESPT-B5 EESPT-D6b	science/ non-science	χ^2
3.4.	students' energy conservation practices/knowledge of energy-related topics	EESPT-B3a EESPT-B3b EESPT-D6b	science non-science	χ^2
3.5.	energy definition and factors influencing the teaching of energy education	EESPT-B4 EESPT-C1 through C8	definition, factors	Spearman Rank

Figure 4

Research Question 4

Hypothesis Number	Variable Description	Survey Source	Comparison	Statistic
4.1.	prior energy education experiences	EESP-A1 EESP-A2	DOE vs Peer	χ^2
4.2	energy topics in curriculum before workshop	EESP-A3 EESPT-A3	DOE vs Peer	χ^2
4.3.	energy education topics in 1982-1983 school curriculum	EESP-B6 EESPT-B5	DOE vs Peer	χ^2
4.4.	kinds of curricular materials utilized in energy education	EESP-B7 EESPT-B6	DOE vs Peer	χ^2
4.5.	recommended procedures for energy education/curricular design	EESP-B1 EESP-B3 EESPT-B1 EESPT-B2	DOE with Peer	Spearman Rank
4.6.	energy definition	EESP-B5 EESPT-B4	DOE vs Peer	χ^2
4.7.	factors influencing the teach ing of energy education	EESP-C1-10 EESP-C1-8	DOE with Peer	Spearman Rank
4.8.	students' energy conservation practices/knowledge of energy-related topics	EESP-B4a EESP-B4b EESPT-B3a EESPT-B3b	DOE vs Peer	χ^2
4.9.	traditional/ non traditional home energy source	EESP-D9 EESPT-D7	DOE vs Peer	χ^2

CHAPTER IV

FINDINGS OF THE STUDY

This chapter includes the findings for each of the research questions and hypotheses and a summary.

Research Question One

Question one focused on the characteristics of the DOE participants and their peer teachers prior to their participation in the DOE or local inservice energy education workshops, respectively. This question generated eight null hypotheses. For each hypothesis, a frequency distribution and chi-square statistic were computed. Whenever the expected cell frequency was less than 5.0, either Phi or Cramer's statistic was computed. The significance of Phi was tested by using the formula ($X^2=N\phi^2$). Then the significance level was found by using the chi-square table. The Cramer's V is significant if the chi-square is significant. All hypotheses were tested at the $p \leqq .05$ level of significance.

Question 1.

What were the characteristics of the DOE workshop participants and their peer teachers?

Hypothesis 1.1. There is no significant difference between the 1980 and the 1981 DOE participants' energy education experiences prior to the UMO workshops.

The results of the frequency distribution and the chi-square or Phi statistic of the 1980 and the 1981 DOE participants' energy education experiences prior to their participation in the UMO workshop are delineated in Table 6. The results of the chi-square or Phi statistic were not significant. The null hypothesis was accepted. It was concluded that there was no statistically significant difference between the 1980 and the 1981 DOE participants regarding their energy education experiences prior to the UMO workshops.

Hypothesis 1.2. There is no significant difference between the 1980 and the 1981 peer teachers' energy education experiences prior to the local inservice energy education workshops.

Table 7 contains the results of frequency distribution and chi-square or Phi statistic of the 1980 and the 1981 peer teachers regarding their energy education experiences prior to the local inservice energy education workshops. The results of the chi-square or Phi statistic were not statistically significant. The null hypothesis was accepted. It was concluded that there was no statistically significant difference between the 1980 and the 1981 peer teachers regarding their energy education experiences prior to the local inservice energy education workshops.

Hypothesis 1.3. There is no significant difference between the 1980 and the 1981 DOE participants in the number of energy education topics taught prior to the UMO workshops.

TABLE 6

Frequency Distribution and Chi-Square Statistic of the 1980 and the 1981 DOE Participants Regarding Their Prior Energy Education Experiences

Variable Label	1980		1981		X^2	p
	n	%	n	%		
One hour workshop	0	0.0	2	9.1	0.23028[a]	0.20
Half day workshop	3	10.7	3	13.6	0.04464[a]	0.80
One day workshop	2	7.1	4	18.2	0.16862[a]	0.80
More than one day workshop	2	7.1	2	9.1	0.03564[a]	0.90
Course on energy	6	21.4	1	4.5	0.24152[a]	0.10
Other	8	28.6	4	18.2	0.27074	0.60
None	17	60.7	12	54.5	0.02252	0.88
N	28		28			
df=1						

[a] Phi

TABLE 7

Frequency Distribution and Chi-Square Statistic of the 1980 and the 1981 Peer Teachers Regarding Their Prior Energy Education Experiences

Variable Label	1980		1981		X^2	p
	n	%	n	%		
One hour workshop	0	0.0	0	0.0	0.0000	
Half day workshop	0	0.0	3	21.4	0.35161[a]	0.10
One day workshop	1	6.7	2	14.3	0.12502[a]	0.70
More than one day workshop	1	6.7	2	14.3	0.12502[a]	0.70
Course on energy	1	6.7	2	14.3	0.12502[a]	0.70
Other	3	20.0	0	0.0	0.32816[a]	0.10
None	10	66.7	7	50.0	0.2844	0.59
N	15		14			
df=1						

[a] Phi

The results of the chi-square or Phi statistic were not significant (Table 8). The null hypothesis was accepted. It was concluded that there was no statistically significant difference between the 1980 and the 1981 DOE participants' energy education topics taught prior to the UMO workshops.

Hypothesis 1.4. There is no significant difference between the 1980 and the 1981 peer teachers in the number of energy education topics taught prior to the local inservice energy education workshops.

The frequency distribution and the chi-square or Phi statistic results are given in Table 9. The results of the chi-square or Phi statistic were not statistically significant. The null hypothesis was accepted. Therefore, it was concluded that a significant difference did not exist between the 1980 and the 1981 peer teachers regarding the energy education topics in their curriculum before the local inservice energy education workshops.

Hypothesis 1.5. There is no significant difference between the 1980 and the 1981 DOE participants in the curricular materials utilized to teach energy education.

Table 10 delineates the results of the frequency distribution and chi-square or Phi statistic. The results of the chi-square or Phi statistic were not statistically significant. The null hypothesis was accepted. Consequently, it was concluded that there was no statistically significant difference between the 1980 and the 1981 DOE participants concerning the types of curricular materials utilized to teach energy education.

TABLE 8

Frequency and Chi-Square Statistic of the 50 DOE Participants' Prior Energy Education Topics in Their Curriculum

Variable Label	1980		1981		X^2	p
	n	%	n	%		
Conventional energy	14	50.0	10	45.5	0.00117	0.97
Economics of energy	4	14.3	7	31.8	0.21009[a]	0.20
Energy conservation and lifestyles	8	28.6	9	40.9	0.37633	0.54
Energy and environmental interaction	7	25.0	8	36.4	0.31308	0.58
Future energy alternatives	11	39.3	9	40.9	0.0000	1.00
History of energy	4	14.3	4	18.2	0.05275[a]	0.80
Home energy audits	4	14.3	4	18.2	0.05275[a]	0.80
Regulation and operation of utility companies	1	3.6	3	13.6	0.18416[a]	0.20
Renewable energy	7	25.0	7	31.8	0.04654	0.83
Scientific principles of energy	9	32.1	8	36.4	0.00014	0.99
None	6	21.4	4	18.2	0.04029[a]	0.80
Other	5	17.9	2	9.1	0.12541[a]	0.50
N	28		22			
df=1						

[a] Phi

TABLE 9

Frequency Distribution and Chi-Square Statistic
of the 29 Peer Teachers' Prior Energy
Education Topics in Their Curriculum

Variable Label	1980		1981		X^2	p
	n	%	n	%		
Conventional energy	9	60.0	5	35.7	0.87608	0.35
Economics of energy	4	26.7	1	7.1	0.25828[a]	0.20
Energy conservation and lifestyles	6	40.0	5	35.7	0.0	1.00
Energy and environmental interaction	6	40.0	3	21.4	0.20059[a]	0.30
Future energy alternatives	6	40.0	5	35.7	0.0	1.00
History of energy	2	13.3	4	28.6	0.18798	0.50
Home energy audits	4	26.7	1	7.1	0.25828[a]	0.20
Regulation and operation of utility companies	1	6.7	1	7.1	0.00939[a]	0.98
Renewable energy	4	26.7	3	21.4	0.06117[a]	0.80
Scientific principles of energy	4	26.7	4	28.6	0.02130[a]	0.95
None	4	26.7	6	42.9	0.17021[a]	0.50
N	15		14			
df=1						

[a] Phi

TABLE 10

Frequency Distribution and Chi-Square Statistic of the 50 DOE Participants Regarding the Kinds of Curricular Materials Utilized to Teach Energy Education

Variable Label	1980		1981		X^2	p
	n	%	n	%		
Business or industry produced energy education materials	14	50.0	17	77.3	2.81803	0.09
Commerically produced textbooks	12	42.9	8	36.4	0.03044	0.86
Films	15	53.6	18	81.8	3.21217	0.07
PEEC materials	11	39.3	7	31.8	0.06214	0.08
Resource speaker	8	28.6	3	13.6	0.17897[a]	0.70
Self-produced energy education units or materials	19	67.9	17	81.0	0.49079	0.48
Not taught	3	10.7	0	0.0	0.22395[a]	0.70
Other	4	14.3	1	4.5	0.16116[a]	0.30
N	28		22			
df=1						

[a] Phi

Hypothesis 1.6. There is no significant difference between the 1980 and the 1981 peer teachers in the curricular materials utilized to teach energy education.

The results of the frequency distribution and the chi-square or Phi statistic of the 1980 and the 1981 peer teachers regarding the kinds of curricular materials utilized to teach energy education are presented in Table 11. The results of the chi-square or Phi were not statistically significant. The null hypothesis was accepted. Therefore, it was determined that a statistically significant difference did not exist between the 1980 and the 1981 peer teachers concerning the kinds of curricular materials used to teach energy education.

Hypothesis 1.7. There is no significant difference between the 1980 and the 1981 DOE participants in the degree of their agreement with factors influencing their teaching of energy education.

Table 12 provides the results of the frequency distribution and chi-square, or Cramer's V statistic for the factors influencing the 1980 and the 1981 DOE participants' teaching of energy education. Subsequently, Table 13 delineates the mean, standard deviation, and the chi-square or Cramer's V of the factors influencing the DOE participants' teaching of energy education. The results of the chi-square were not significant. The null hypothesis was accepted. It was concluded that a significant relationship existed between the 1980 and the 1981 DOE participants concerning their perceptions of the factors influencing their teaching of energy education for community support.

TABLE 11

Frequency Distribution and Chi-Square Statistic of the 29 Peer Teachers Regarding the Kinds of Curricular Materials Utilized to Teach Energy Education

Variable Label	1980		1981		X^2	p
	n	%	n	%		
Business or industry produced energy education materials	5	33.3	4	28.6	0.05143[a]	0.80
Commerically produced textbooks	5	33.3	6	42.9	0.02110	0.88
Films	6	40.0	6	42.9	0.0	1.00
PEEC materials	1	6.7	1	7.1	0.00939[a]	0.98
Resource speaker	3	20.0	1	7.1	0.18632[a]	0.50
Self-produced energy education units or materials	7	46.7	4	28.6	0.38517	0.53
Not taught	2	13.3	3	21.4	0.10709[a]	0.70
Other	2	13.3	0	0.0	0.26294[a]	0.20
N	15		14			
df=1						

[a] Phi

TABLE 12

Frequency Distribution and Chi-Square Statistic of the Factors
Influencing the 1980 and the 1981 DOE Participants'
Teaching of Energy Education

Variable Label	Agree				Neutral				Disagree				X^2	p
	1980		1981		1980		1981		1980		1981			
	n	%	n	%	n	%	n	%	n	%	n	%		
School District Administration	6	21.4	11	50.0	11	39.3	6	27.3	11	39.3	5	22.7	4.53650	0.10
Principal's Active Support	0	0.0	0	0.0	0	0.0	0	0.0	28	100.0	22	100.0	0.0[a]	
School Board	6	21.4	9	40.9	10	35.7	9	40.9	12	42.9	4	18.2	3.99009	0.14
Community Support	5	17.9	14	63.6	17	60.7	7	31.8	6	21.4	1	4.5	0.47846[b]	0.00*
Teachers' Interest	12	42.9	13	59.1	13	46.4	8	36.4	3	10.7	1	4.5	0.25306[b]	0.46
Students' Interest	18	64.3	18	81.8	7	25.0	4	18.2	3	10.7	0	0.0	0.25074[b]	0.21
Energy Education as a Basic	23	82.1	20	90.9	0	0.0	1	4.5	5	17.9	1	4.5	0.25306[b]	0.20
Qualified to teach energy	25	89.3	21	95.5	2	7.1	0	0.0	1	3.6	1	4.5	0.18175[b]	0.42

N=50

df=2

---

[a] Statistic cannot be computed when the number of non-empty rows or columns is one.

[b] Cramer's V

*$p \leq .05$

TABLE 13

Mean, Standard Deviation and Chi-Square Statistic for the Factors Influencing the 50 DOE Participants' Teaching of Energy Education

Variable Label	1980		1981		X^2	p
	Mean	S.D.	Mean	S.D.		
School District Administration	2.1791	0.772	1.7271	0.827	4.56350	0.10
Principal's Active Support	10.429	2.949	9.364	2.887	0.0[a]	
School Board	2.214	0.787	1.773	0.752	3.99009	0.14
Community Support	2.036	0.637	1.409	0.590	0.47846[b]	0.00*
Student' Interest	1.464	0.693	1.182	0.395	0.25074[b]	0.21
Teachers' Interest	1.679	0.670	1.455	0.596	0.25306[b]	0.46
Energy Education as a Basic	1.357	0.780	1.136	0.468	0.25306[b]	0.20
Qualified to Teach Energy Education	1.143	0.448	1.091	0.426	0.18175[b]	0.44

df=2

---

[a] Statistic cannot be computed when the number of non-empty rows or columns is one.

[b] Cramer's V

*$p \leq .05$

Hypothesis 1.8. There is no significant difference between the 1980 and the 1981 peer teachers in the degree of their agreement with the factors influencing their teaching of energy education.

The frequency distribution and the Cramer's V statistical results of the factors influencing the 1980 and the 1981 peer teachers' teaching of energy education are listed in Table 14. In addition, Table 15 delineates the mean, standard deviation, and Cramer's V statistic for the factors influencing the 29 peer teachers' teaching of energy education. The results of the Cramer's V statistic were not statistically significant. The null hypothesis was accepted. Therefore, it was concluded that a statistically significant difference did not exist between the 1980 and the 1981 peer teachers regarding their perceptions of the factors influencing their teaching of energy education.

Research Question Two

Question two investigated what effect participation in the DOE Faculty Development summer energy education workshop at UMO had on the DOE participants. The question generated five null hypotheses. For hypotheses 2.1., 2.3., and 2.4., frequencies and chi-square statistic were computed for each variable. Whenever the expected cell frequency was less than 5.0, either Phi or Cramer's V statistic was reported. The significance of Phi was tested by using the formula ($X^2=N\phi^2$). Then the significance level was found by using the chi-square table. The Cramer's V is significant if the chi-square is significant. For hypotheses 2.2. and 2.5., a Spearman Rank Correlation was computed. All hypotheses were tested at the $p \leq .05$ level of significance.

TABLE 14

Frequency Distribution and Cramer's V Statistic of the Factors Influencing the 1980 and the 1981 Peer Teachers' Teaching of Energy Education

Variable Label	Agree				Neutral				Disagree				Cramer's V	p
	1980		1981		1980		1981		1980		1981			
	n	%	n	%	n	%	n	%	n	%	n	%		
School District Administration	5	33.3	8	57.1	7	46.7	4	28.6	3	20.0	2	14.3	0.24055	0.43
Principal's Active Support	5	33.3	5	35.7	8	53.3	9	64.3	2	13.3	0	0.0	0.26436	0.36
School Board	3	20.0	2	14.3	11	73.3	11	78.6	1	6.7	1	7.1	0.07559	0.92
Community Support	3	20.0	5	35.7	11	73.3	9	64.3	1	6.7	0	0.0	0.23979	0.43
Teachers' Interest	8	53.3	9	64.3	6	40.0	5	35.7	1	6.7	0	0.0	0.19622	0.57
Students' Interest	7	46.7	8	57.1	6	40.0	4	28.6	2	13.3	2	14.3	0.12215	0.81
Energy Education as a Basic	10	66.7	12	85.7	4	26.7	2	14.3	1	6.7	0	0.0	0.25025	0.40
Qualified to Teach Energy	8	53.3	6	42.9	4	26.7	7	50.0	3	20.0	1	7.1	0.26729	0.35

N=29

df=2

$^{a}X^{2}$ may be invalid because expected cell frequency is less than 5.0.

TABLE 15

Mean, Standard Deviation, and Cramer's V Statistic
for the Factors Influencing the 29 Peer Teachers'
Teaching of Energy Education

Variable Label	1980		1981		Cramer's V	p
	Mean	S.D.	Mean	S.D.		
School District Administration	1.867	0.743	1.571	0.756	0.24055	0.43
Principal's Active Support	1.800	0.676	1.643	0.497	0.26436	0.36
School Board	1.867	0.516	1.929	0.475	0.07559	0.92
Community Support	1.867	0.516	1.643	0.497	0.23979	0.43
Students' Interest	1.667	0.724	1.571	0.756	0.19622	0.57
Teachers' Interest	1.533	0.640	1.357	0.497	0.12215	0.81
Energy Education as a Basic	1.400	0.632	1.143	0.363	0.25025	0.40
Qualified to Teach Energy Education	1.667	0.816	1.643	0.633	0.26729	0.35

df=2

Question 2.

What effect did participation in the DOE Faculty Development summer energy education workshops at UMO have on the DOE participants?

Hypothesis 2.1. There is no significant difference between the 1980 and the 1981 DOE participants in the kind of energy education topics included in their 1982-1983 curriculum.

The results of the frequency distribution and chi-square or Phi Cramer's V statistic of the energy education topics included in the 1982-1983 school curriculum of the DOE participants are delineated in Table 16. Only the 45 DOE participants who are teaching in the public schools during 1982-1983 were included in this statistical analysis. The chi-square or Phi analysis was not statistically significant. Therefore, the null hypothesis was accepted. It was concluded that a statistically significant difference did not exist between the 1980 and the 1981 DOE participants regarding the energy education topics in their 1982-1983 school curriculum.

Hypothesis 2.2. There is no significant relationship between the DOE participants' recommended procedures for including energy education in the school curriculum and their curricular design.

The Spearman Rank Correlation between the 50 DOE participants' recommendations for including energy education in the school curriculum and their curricular design is found in Table 17. Statistically significant relationships were found between the DOE participants' recommen-

TABLE 16

Frequency Distribution and Chi-Square Statistic of 45 DOE Participants'[a] Energy Education Topics in Their 1982-1983 School Curriculum

Variable Label	1980		1981		X^2	p
	n	%	n	%		
Conventional energy	18	69.2	14	73.7	0.0	1.00
Economics of energy	11	42.3	13	68.4	2.05000	0.15
Energy conservation and lifestyles	17	65.4	15	78.9	0.14780[b]	0.50
Energy and environmental interaction	14	53.8	15	78.9	0.25900[b]	0.10
Future energy alternatives	17	65.4	17	89.5	0.27685[b]	0.10
History of energy	9	34.6	5	26.3	0.08855[b]	0.70
Home energy audits	9	34.6	7	36.8	0.0	1.00
Regulation and operation of utility companies	7	26.9	3	15.8	0.13227[b]	0.50
Renewable energy	20	76.9	17	89.5	0.16214[b]	0.30
Scientific principles of energy	15	57.7	12	63.2	0.00380	0.95
None	0	0.0	1	5.3	0.176635[b]	0.30
Other	4	15.4	0	0.0	0.26701[b]	0.10
N	26		19			
df=1						

[a] consists of those DOE participants who are teaching in the public schools during 1982-1983.

[b] Phi

TABLE 17

Spearman Rank Correlation Between the 50 DOE Participants' Recommendations for Including Energy Education in the School Curriculum and Their Curricular Design

Curricular Design	Recommendations for Including Energy Education				
	Not taught (2%)	Separate course (24%)	Unit within a course (72%)	Within a course but not a whole unit (36%)	Other (6%)
Not taught (8%)	0.5157 .001*	0.2067 .075	-0.0288 .421	0.2780 .025*	0.2181 .064
Separate course (12%)	0.4029 .002*	0.1948 .088	0.3205 .012*	0.3189 .012*	0.3366 0.008*
Unit within a course (64%)	0.2901 .020*	0.1071 .230	0.3101 .014*	-0.0599 .340	0.1556 .140
Within a course but not a whole unit (36%)	0.2868 .022*	0.1441 .159	0.0695 .316	0.3553 .006*	0.1331 .178
Other (6%)	0.5157 .001*	0.2067 .075	0.1282 .188	-0.0118 .468	0.4787 .001*

* $p \leq .05$

dations for including energy education in the school curriculum and their curricular design for not teaching energy education (rho=0.05157), for unit within a course (rho=0.3101), for within a course but not a whole unit (rho=0.3553), and for other approaches (rho=0.4787). The DOE participants were to check all that applied. The results of the frequency distribution for the DOE participants' recommendations for including energy education in the school curriculum were as follows: for not teaching energy education (2%), for separate course (24%), for unit within a course (72%), for within a course but not a whole unit (36%), and for other approaches (6%). The results of the frequency distribution for the DOE participants' curricular design were as follows: for not teaching energy education (8%), for separate course (12%), for unit within a course (64%), for within a course but not a whole unit (36%), and for other approaches (6%). The null hypothesis was rejected. It was concluded that statistically significant relationships existed between the DOE participants' recommendations for including energy education in the school curriculum and their curricular design for not teaching energy education, for unit within a course, for within a course but not a whole unit, and for other approaches. Also, it was concluded that the most frequently utilized curricular design was unit within a course approach followed by within a course but not a whole unit approach.

Hypothesis 2.3. There is no significant difference between science and non-science DOE participants in the energy education topics taught before and after the UMO workshops.

Table 18 gives the results of the frequency distribution and chi-square or Phi statistic between the science and non-science DOE participants in the energy education topics taught before and after the UMO workshops. Only the 45 DOE participants who were teaching in the public schools during 1982-1983 were included in this statistical analysis. The result of the chi-square statistic for scientific principles of energy (7.26238) was statistically significant. Table 19 delineates the frequency distribution and chi-square or Phi statistic of the 45 DOE participants' energy education topics in their 1982-1983 school curriculum by science and non-science teachers. The chi-square statistic for energy and environmental interaction (7.79283) and for scientific principles of energy (7.13348) was statistically significant. Table 20 provides the results of the frequency distribution and Phi statistic of the DOE science teacher participants' energy education topics included in their curriculum before and after their participation in the UMO workshop. The results of the Phi value for conventional energy (0.41833), for history of energy (0.47809), and for other (0.8000) were statistically significant. Table 21 delineates the results of the frequency distribution and Phi statistic of the DOE non-science teacher participants' energy education topics included in their school curriculum before and after their participation in the UMO workshop. The results of the Phi value for history of energy (0.67006) for regulation and operation of utility companies (0.57009), and for other (1.0000) were statistically significant. The null hypothesis was rejected. It was concluded that there was a statistically significant difference between the science and non-science DOE participants for the scientific principles of energy

TABLE 18

Frequency Distribution and Chi-Square Statistic of 45 DOE Participants'[a] Energy Education Topics in Their School Curriculum Before the UMO Workshop by Science and Non-Science Teachers

Variable Label	Science		Non-Science		X^2	p
	n	%	n	%		
Conventional energy	15	55.6	5	28.8	2.34375	0.13
Economics of energy	5	18.5	3	16.7	0.02376[b]	0.90
Energy conservation and lifestyles	9	33.3	4	22.2	0.22085	0.64
Energy and environmental interaction	11	40.7	3	16.7	0.25475	0.10
Future energy alternatives	12	44.4	5	27.8	0.66570	0.41
History of energy	2	7.4	4	22.2	0.21350[b]	0.20
Home energy audits	4	14.8	0	0.0	0.25503[b]	0.10
Regulation and operation of utility companies	0	0.0	2	11.1	0.26414[b]	0.10
Renewable energy	9	33.3	3	16.7	0.18464[b]	0.30
Scientific principles of energy	13	48.1	1	5.6	7.26238	0.01*
None	4	14.8	6	33.3	0.21822[b]	0.20
Other	3	11.1	2	11.1	0.0[b]	
N	27		18			
df=1						

[a] consists of those who are teaching in the public schools during 1982-1983.

[b] Phi

* $p \le .05$

TABLE 19

Frequency Distribution and Chi-Square Statistic of 45 DOE Participants'[a] Energy Education Topics in Their 1982-1983 School Curriculum by Science and Non-Science Teachers

Variable Label	Science		Non-Science		X^2	p
	n	%	n	%		
Conventional energy	21	77.8	11	61.1	0.76172	0.38
Economics of energy	15	55.6	9	50.0	0.00372	0.95
Energy conservation and lifestyles	20	74.1	12	66.7	0.04056	0.84
Energy and environmental interaction	22	81.5	7	38.9	7.79283	0.01*
Future energy alternatives	22	81.5	12	66.7	0.16888[b]	0.30
History of energy	7	25.9	7	38.9	0.34994	0.55
Home energy audits	10	37.0	6	33.3	0.0	1.00
Regulation and operation of utility companies	5	18.5	5	27.8	0.13393	0.71
Renewable energy	24	88.9	13	72.2	0.21356[b]	0.20
Scientific principles of energy	21	77.8	6	33.3	7.13348	0.01*
None	0	0.0	1	5.6	0.18464[b]	0.30
Other	2	7.4	2	11.1	0.06376[b]	0.70
N	27		18			
df=1						

---

[a] consists of those who are teaching in the public schools during 1982-1983.

[b] Phi

*$p \leq .05$

TABLE 20

Frequency Distribution and Phi Statistic
of the 27 DOE Science Teacher Participants' Energy Education Topics
Before and After the UMO Workshop

Variable Label	Before		After		ϕ	p
	n	%	n	%		
Conventional energy	15	55.6	21	77.8	0.41833	0.05*
Economics of energy	5	18.5	15	55.6	0.23452	0.30
Energy conservation and lifestyles	9	33.3	20	74.1	0.23905	0.30
Energy and environmental interaction	11	40.7	22	81.5	0.20124	0.30
Future energy alternatives	12	44.4	22	81.5	0.23452	0.30
History of energy	2	7.4	7	25.9	0.47809	0.02*
Home energy audits	4	14.8	10	37.0	0.32784	0.10
Regulation and operation of utility companies	0	0.0	5	18.5	a	
Renewable energy	9	33.3	24	88.9	0.25000	0.20
Scientific principles of energy	13	48.1	21	78.8	0.33678	0.10
None	4	14.8	0	0.0	a	
Other	3	11.1	2	7.4	0.8000	0.00*
N	27		27			
df=1						

[a] Statistic cannot be computed because the number of non-empty rows or columns is one.

*$p \leq .05$

TABLE 21

Frequency Distribution and Phi Statistic
of the 18 DOE Non-Science Teacher Participants' Energy Education Topics
Before and After the UMO Workshop

Variable Label	Before		After		ϕ	p
	n	%	n	%		
Conventional energy	5	27.8	11	61.1	0.01414	0.99
Economics of energy	3	16.7	9	50.0	0.44721	0.10
Energy conservation and lifestyles	4	22.2	12	66.7	0.18898	0.50
Energy and environmental interaction	3	16.7	7	38.9	0.05096	0.90
Future energy alternatives	5	27.8	12	66.7	0.08771	0.95
History of energy	4	22.2	7	38.9	0.67006	0.01*
Home energy audits	0	0.0	6	33.3	a	
Regulation and operation of utility companies	2	11.1	5	27.5	0.57009	0.02*
Renewable energy	3	16.7	13	72.2	0.27735	0.30
Scientific principles of energy	1	5.6	6	33.3	0.17150	0.50
None	6	33.3	1	5.6	0.34300	0.20
Other	2	11.1	2	11.1	1.00000	0.00*
N	18		18			
df=1						

[a] Statistic cannot be computed because the number of non-empty rows or columns is one.

* $p \leq .05$

before their participation in the UMO workshops. Also, it was concluded that there was a statistically significant difference between the DOE science and non-science participants for energy and environmental interaction and for scientific principles of energy included in their 1982-1983 school curriculum. A statistically significant difference was found for the DOE science teacher participants' energy education topics included in their curriculum before and after their participation in the UMO workshop for conventional energy, for history of energy, and for other energy topics. In addition, it was concluded that there was a statistically significant difference for the non-science DOE teacher participants' energy education topics included in their school curriculum before and after their participation in the UMO workshop for history of energy education, for regulation and operation of utility companies, and for other energy topics.

Hypothesis 2.4. There is no significant difference between the science and non-science DOE participants' perceptions of their students' energy conservation practices and knowledge of energy-related topics.

The results of the frequency distribution and the Cramer's V statistic of the 45 DOE science and non-science participants' perceptions of their students' energy conservation practices and knowledge of energy-related topics are included in Table 22. Only those DOE participants who are teaching in the public schools during 1982-1983 were included in this statistical analysis. The results of the Cramer's V statistic were not significant between the science and non-science DOE participants regarding their perceptions of their students' energy conservation practices and knowledge of energy-related topics. How-

TABLE 22

Frequency Distribution and Cramer's V Statistic of 45 DOE Participants'[a] Perceptions of Their Students' Energy Conservation Practices and Knowledge of Energy-Related Topics

Variable Label	Science		Non-Science	
	n	%	n	%
Practices				
Inappropriate	1	3.7	0	0.0
	6	22.2	6	33.3
to	12	44.4	10	55.6
	6	22.2	2	11.1
Appropriate	2	7.4	0	0.0
N	27		18	
Cramer's V = 0.27979	df=4		p=0.47	
Knowledge				
Poor	0	0.0	2	11.1
	5	18.5	4	22.2
to	12	44.4	9	50.0
	8	29.6	3	16.7
Good	2	7.4	0	0.0
N	27		18	
Cramer's V = 0.34063	df=4		p=0.27	

[a] consists of those who are teaching in the public schools during 1982-1983.

ever, more science DOE participants rated their students' energy conservation parctices and knowledge of energy-related topics higher than the non-science DOE participants.

Hypothesis 2.5. There is no significant relationship between the DOE participants' perceptions of the factors influencing their teaching of energy education and the DOE participants' degree of agreement with the energy education definition.

The results of the Spearman Rank Correlation between the DOE participants' perceptions of the factors influencing their teaching of energy education and their degree of agreement with the energy education definition are given in Table 23. The other administrative and community support factor included school district administration, school board, and community support. There were statistically significant positive correlations between the principal's active support and other administrative and community support (rho=0.7462), between other administrative and community support and students' interest (rho=0.3817), between students' interest and teachers' interest (rho=0.3939), between students' interest and energy education as a basic (rho=0.3486), between student's interest and qualified to teach energy education (rho=0.4381), between teachers' interest and energy education as a basic (rho=0.4702), between energy education as a basic and qualified to teach energy education (rho=0.4298), and between energy education definition and energy education as a basic (rho=0.3694). The null hypothesis was rejected. It was concluded that there were significant relationships between the DOE participants' perceptions of the factors

TABLE 23

Spearman Rank Correlation Between the Factors Influencing the 50 DOE Participants' Teaching of Energy Education and the Energy Definition

Variable Label	Principal's Active Support	Other Administrative and Community Support	Students' Interest	Teachers' Interest	Energy Education as a Basic	Qualified to Teach Energy Education	Energy Education Definition
Principal's Active Support	1.0000 .000*	0.7462 .001*	0.1922 .091	0.0370 .399	0.0791 .293	-0.0322 .412	0.0791 .293
Other Administrative and Community Support	0.7462 .991*	1.0000 .000*	0.3817 .003*	0.1549 .141	0.0634 .331	0.2140 .068	0.0634 .331
Students' Interest	0.1922 .091	0.3817 .003*	1.0000 .000*	0.3939 .002*	0.3486 .007*	0.4381 .001*	0.2098 .072
Teachers' Interest	0.0370 .399	0.1549 .141	0.3939 .002*	1.0000 .000*	0.4702 .001*	0.1593 .135	-0.0087 .476
Energy Education as a Basic	0.0483 .370	0.1809 .104	0.3486 .007*	0.4702 .001*	1.0000 .000	0.4298 .001*	0.3694 .004*
Qualified to Teach Energy Education	-0.0322 .412	0.2140 .068	0.4381 .001*	0.1593 .135	0.4298 .001*	1.0000 .000*	0.1651 .126
Energy Education Definition	0.791 .293	0.0634 .331	0.2098 .072	-0.0087 .476	0.3694 .004*	0.1651 .126	1.0000 .000*

*$p \leq .05$

influencing their teaching of energy education and their degree of agreement with the energy education definition for the factors discussed above.

Research Question Three

Question three investigated what effect participation in the local inservice energy education workshops, conducted by the DOE participants, had on the peer teachers. The question generated five null hypotheses. For hypotheses 3.1., 3.3., and 3.4., frequencies and chi-square statistic were computed for each variable. Whenever the expected cell frequency was less than 5.0, either Phi or Cramer's V was computed. The significance of Phi was tested by using the formula ($X^2=N\phi^2$). Then the significance level was found by using the chi-square table. The Cramer's V is significant if the chi-square is significant. For hypotheses 3.2. and 3.5., a Spearman Rank Correlation was computed. All hypotheses were tested at the $p\leqq.05$ level of significance.

Question 3.

What effect did participation in the local inservice energy education workshops, conducted by the DOE participants, have on the peer teachers?

Hypothesis 3.1. There is no significant difference between the 1980 and the 1981 peer teachers in the kind of energy education topics included in their 1982-1983 school curriculum.

The results of the frequency distribution and chi-square or Phi statistic of the energy education topics included in the peer teachers'

1982-1983 school curriculum were not statistically significant (Table 24). The null hypothesis was accepted. Therefore, it was concluded that there were no statistically significant differences between the 1980 and the 1981 peer teachers concerning the energy education topics in their 1982-1983 school curriculum.

Hypothesis 3.2. There is no significant relationship between the peer teachers' recommended procedures for including energy education in the curriculum and their curricular design.

The Spearman Rank Correlation between the 29 peer teachers' recommendations for including energy education in the school curriculum and their curricular design is found in Table 25. Statistically significant relationships were found between the curricular design and the recommendations for including energy education in the school curriculum for not teaching energy education (rho=0.3700) and for within a course but not a whole unit approach (rho=0.3442). The peer teachers were instructed to check all that applied. The results of the frequency distribution for the peer teachers' recommendations for including energy education in the school curriculum were as follows: for not teaching energy education (3.4%), for separate course (17.2%), for unit within a course (62.1%), for within a course but not a whole unit (24.1%), and for other approach (0%). The results of the frequency distribution for the peer teachers' curricular design were as follows: for not teaching energy education (20.7%), for separate course (6.9%), for unit within a course (34.5%), for within a course but not a whole unit (41.4%), and for other approaches (3.4%). It was concluded that a significant relationship existed between the peer teachers' recommendations for includ-

TABLE 24

Frequency Distribution and Chi-Square Statistic of the Energy Education Topics in the 28 Peer Teachers'[a] 1982-1983 School Curriculum

Variable Label	1980		1981		X^{2b}	p
	n	%	n	%		
Conventional energy	7	50.0	8	57.1	0.0	1.00
Economics of energy	8	57.1	6	42.9	0.14286	0.71
Energy conservation and lifestyles	10	71.4	7	50.0	0.59893	0.42
Energy and environmental interaction	5	35.7	4	28.6	0.07647	0.70
Future energy alternatives	10	71.4	10	71.4	0.0[c]	
History of energy	2	14.3	4	28.6	0.17408[c]	0.20
Home energy audits	4	28.6	4	28.6	0.0[c]	
Regulation and operation of utility companies	2	14.3	0	0.0	0.27735[c]	0.20
Renewable energy	9	64.3	6	42.9	0.57436	0.45
Scientific principles of energy	4	28.6	7	50.0	0.59893	0.44
None	2	14.3	4	28.6	0.17408[c]	0.50
N	14		14			
df=1						

[a] One peer teacher did not complete this question.

[b] X^2 may be invalid because expected cell frequency is less than 5.0.

[c] Phi

TABLE 25

Spearman Rank Correlation Between the 29 Peer Teachers' Recommendations for Including Energy Education in the School Curriculum and Their Curricular Design

Curricular Design	Recommendations for Including Energy Education				
	Not taught (3.4%)	Separate course (17.2%)	Unit within a course (62.1%)	Within a course but not a whole unit (24.1%)	Other (0%)
Not taught (20.7%)	0.3700 .024*	-0.0078 .484	0.0484 .402	-0.2881 .065	99.0000 a
Separate course (6.9%)	-0.0514 .396	0.2360 .109	-0.0677 .364	0.1645 .197	99.0000 a
Unit within a course (34.5%)	-0.1374 .239	-0.1391 .236	0.2681 .080	-0.0702 .359	99.0000 a
Within a course but not a whole unit (41.4%)	-0.1588 .205	-0.0128 .474	-0.2090 .138	0.3442 .034*	99.0000 a
Other (3.4%)	-0.0357 .427	-0.0863 .328	0.1477 .222	-0.1066 .291	99.0000 a

$p \leq .05$

[a] The coefficient cannot be computed.

ing energy education in the school curriculum and their curricular design for not teaching energy education and for within a course but not a whole unit approach.

Hypothesis 3.3. There is no significant difference between the science and non-science peer teachers in the energy education topics taught before and after the local inservice energy education workshop.

A frequency distribution and chi-square or Phi statistic of 28 peer teachers' energy education topics included in their school curriculum before their participation in the local inservice energy education workshop by science and non-science teachers are found in Table 26. The results of the Phi statistic for scientific principles of energy (0.57054) and for no energy topics (0.44151) were statistically significant. In Table 27 are listed the results of the frequency distribution and chi-square or Phi statistic of 28 science and non-science peer teachers' energy education topics included in their 1982-1983 school curriculum. The results of the chi-square or Phi statistic were not statistically significant. The results of the frequency distribution and the Phi statistic of the 12 science peer teachers' energy education topics included in their school curriculum before and after participation in the local inservice energy education workshop are listed in Table 28. The Phi statistic for the history of energy (0.63246), for home energy audits (0.77460), for scientific principles of energy (0.65714), for no energy topics (0.67420), for economics of energy (0.83666), and for energy and environmental interaction (1.00000) were statistically significant. In Table 29 are found the results of the frequency distribution and Phi statistic for the 16 non-science peer teachers' energy education

TABLE 26

Frequency Distribution and Chi-Square Statistic of 28 Peer Teachers'[a]
Energy Education Topics Included in Their School Curriculum
Before the Local Inservice Energy Education Workshop
By Science and Non-Science Teachers

Variable Label	Science		Non-Science		X^2	p
	n	%	n	%		
Conventional energy	9	75.0	5	31.3	3.64583	0.06
Economics of energy	4	33.3	1	6.3	0.34995[b]	0.10
Energy conservation and lifestyles	4	33.3	7	43.8	0.10555[b]	0.70
Energy and environmental interaction	6	50.0	3	18.8	0.33113[b]	0.10
Future energy alternatives	6	50.0	5	31.3	0.18999[b]	0.50
History of energy	2	16.7	4	25.0	0.10050[b]	0.70
Home energy audits	3	25.0	2	12.5	0.16151[b]	0.50
Regulation and operation of utility companies	1	8.3	1	6.3	0.04003[b]	0.90
Renewable energy	4	33.3	3	18.8	0.16667[b]	0.50
Scientific principles of energy	7	58.3	1	6.3	0.57054[b]	0.01*
None	1	8.3	8	50.0	0.44151[b]	0.02*
Other	1	8.3	0	0.0	0.22222[b]	0.70
N	1		16			
df=1						

[a] Included peer teachers who completed both the before and after energy education topics section.

[b] Phi

*$p \leq .05$

TABLE 27

Frequency Distribution and Chi-Square Statistic of 28 Peer Teachers'[a] Energy Education Topics in Their 1982-1983 School Curriculum By Science and Non-Science Teachers

Variable Label	Science		Non-Science		X^2	p
	n	%	n	%		
Conventional energy	8	66.7	7	43.8	0.22740[b]	0.30
Economics of energy	5	41.7	9	56.3	0.14583	0.70
Energy conservation and lifestyles	8	66.7	9	56.3	0.10555[b]	0.70
Energy and environmental interaction	6	50.0	3	18.8	0.33113[b]	0.10
Future energy alternatives	9	75.0	11	68.8	0.06847[b]	0.80
History of energy	4	33.3	2	12.5	0.25126[b]	0.20
Home energy audits	2	16.7	6	37.5	0.22822[b]	0.30
Regulation and operation of utility companies	1	8.3	1	6.3	0.04003[b]	0.30
Renewable energy	8	66.7	7	43.8	0.22740[b]	0.30
Scientific principles of energy	7	58.3	4	25.0	0.33776[b]	0.10
None	2	16.7	4	25.0	0.10050[b]	0.70
Other	4	33.3	5	31.3	0.02208[b]	0.50
N	12		16			
df=1						

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[a] Included peer teachers who completed both the before and after energy education topics sections.

[b] Phi

TABLE 28

Frequency Distribution and Phi Statistic
of the 12 Science Teachers' Energy Education Topics
Included in Their School Curriculum Before and After
the Local Inservice Energy Education Workshop

Variable Label	Before		After		ϕ	p
	n	%	n	%		
Conventional energy	9	75.0	8	66.7	0.40825	0.20
Economics of energy	4	33.3	5	41.7	0.83666	0.01*
Energy conservation and lifestyles	4	33.3	8	66.7	0.50000	0.10
Energy and environmental interaction	6	50.0	6	50.0	1.00000	0.00*
Future energy alternatives	6	50.0	9	75.0	0.19245	0.70
History of energy	2	16.7	4	33.3	0.63246	0.05*
Home energy audits	3	25.0	2	16.7	0.77460	0.01*
Regulation and operation of utility companies	1	8.3	1	8.3	1.00000	0.00*
Renewable energy	4	33.3	8	66.7	0.50000	0.10
Scientific principles of energy	7	58.3	7	58.3	0.65714	0.05*
None	1	8.3	2	16.7	0.67420	0.02*
Other	1	8.3	2	16.7	0.13484	0.70
N	12		12			
df=1						

*$p \leq .05$

TABLE 29

Frequency Distribution and Phi Statistic of the 16 Non-Science Peer Teachers' Energy Education Topics Included in Their School Curriculum Before and After the Local Inservice Energy Education Workshop

Variable Label	Before		After		ϕ	p
	n	%	n	%		
Conventional energy	5	31.3	7	43.8	0.49266	0.05*
Economics of energy	1	6.3	9	56.3	0.22771	0.50
Energy conservation and lifestyles	7	43.8	9	56.3	0.52381	0.05*
Energy and environmental interaction	3	18.8	3	18.8	0.58974	0.02*
Future energy alternatives	5	31.3	11	68.8	0.45455	0.10
History of energy	4	25.0	2	12.5	0.21822	0.50
Home energy audits	2	12.5	6	37.5	0.48795	0.10
Regulation and operation of utility companies	1	6.3	1	6.3	0.06667	0.80
Renewable energy	3	18.8	7	43.8	0.54470	0.05*
Scientific principles of energy	1	6.3	4	25.0	0.44721	0.10
None	8	50.0	4	25.0	0.28867	0.30
Other	0	0.0	2	12.5	a	
N	16		16			
df=1						

[a] Statistic cannot be computed because the number of non-empty rows or columns is one.

*$p \leq .05$

topics included in their school curriculum before and after their participation in the local energy education workshop. The results of the Phi statistic were statistically significant for conventional energy (0.49266), for energy conservation and lifestyles (0.52381), for energy and environmental interaction (0.58974), and for renewable energy (0.54470). The null hypothesis was accepted. It was concluded that statistically significant relationships existed between the science and non-science peer teachers regarding the energy education topics included in their school curriculum prior to their participation in the local inservice energy education workshops for scientific principles of energy and for no energy topics. Also, it was concluded that statistically significant relationships existed for the 12 science peer teachers' energy education topics included in their school curriculum before and after participation in the local inservice energy education workshops for history of energy, for home energy audits, for scientific principles of energy, for no energy topics, for economics of energy, and for energy and environmental interaction. In addition, statistically significant relationships were found for the 16 non-science peer teachers' energy education topics included in their school curriculum before and after their participation in the local energy education workshops for conventional energy, for energy conservation and lifestyles, for energy and environmental interaction, and for renewable energy. The science peer teachers selected energy conservation and lifestyles, history of energy, and no energy topics more often than the non-science peer teachers.

Hypothesis 3.4. There is no significant difference between the science and non-science peer teachers' perceptions of their students' energy conservation practices and knowledge of energy-related topics.

The results of the frequency distribution and the Cramer's V statistic of the 29 science and non-science peer teachers' perceptions of their students' energy conservation practices and knowledge of energy-related topics are included in Table 30. A statistically significant relationship was found between the science and non-science peer teachers' perceptions of their students' knowledge of energy-related topics (0.41227). The null hypothesis was accepted. Therefore, it was concluded that there was no statistically significant difference between the science and non-science peer teachers' perceptions of their students' energy conservation practices and knowledge of energy-related topics.

Hypothesis 3.5. There is no significant relationship between the peer teachers' perceptions of the factors influencing their teaching of energy education and the peer teachers' degree of agreement with the energy education definition.

In Table 31 are found the results of the Spearman Rank Correlation between the peer teachers' perceptions of the factors influencing their teaching of energy education and their degree of agreement with the energy education definition. There were statistically significant positive correlations between the principal's active support and other administration and community support (rho=0.6646), between the principal's active support and energy education as a basic (rho=0.3821), and between the

TABLE 30

Frequency Distribution and Cramer's V Statistic of the 29 Peer Teachers' Perceptions of Their Students' Energy Conservation Practices and Knowledge of Energy-Related Topics by Science and Non-Science

Variable Label	Science		Non-Science	
	n	%	n	%
Practices				
Inappropriate	0	0.0	2	11.8
	4	33.3	4	23.5
To	5	41.7	8	47.1
	3	25.0	2	11.8
Appropriate	0	0.0	1	5.9
N	12		17	
Cramer's V = 0.32816	df=4		$\underline{p}$=.054	
Knowledge				
Poor	0	0.0	2	11.8
	2	16.7	5	29.4
To	8	66.7	5	29.4
	2	16.7	4	23.5
Appropriate	0	0.0	1	5.9
N	12		17	
Cramer's V = 0.41227	df=4		$\underline{p}$=.029	

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[a] X^2 may be invalid because expected cell frequency is less than 5.0.

TABLE 31

Spearman Rank Correlation Between Factors Influencing the 29 Peer Teachers' Teaching of Energy Education and the Energy Education Definition

Variable Label	Principal's Active Support	Other Administrative and Community Support	Students' Interest	Teachers' Interest	Energy Education as a Basic	Qualified to Teach Energy Education	Energy Education Definition
Principal's Active Support	1.0000 .000*	0.6646 .001*	-0.0693 .361	0.2091 .138	0.3821 .020*	0.2846 .067	0.3726 .023*
Other Administrative and Community Support	0.6646 .001*	1.0000 .000*	-0.2328 .112	0.2017 .147	0.4771 .004*	0.1235 .262	0.2167 .129
Students' Interest	- 0.0693 .361	-0.2328 .112	1.0000 .000*	0.2874 .065	0.1043 .295	0.1173 .272	0.1859 .167
Teachers' Interest	0.2091 .138	0.2017 .147	0.2874 .065	1.0000 .000*	0.6485 .001*	0.4037 .015*	0.5925 .001*
Energy Education as a Basic	0.3821 .020*	0.4771 .004*	0.1043 .295	0.6485 .001*	1.0000 .000*	0.4124 .013*	0.4293 .010*
Qualified to Teach Energy Education	0.2846 .067	0.1235 .262	0.1173 .272	0.4037 .015*	0.4124 .013*	1.0000 .000*	0.2364 .109
Energy Education Definition	0.3726 .023*	0.2167 .129	0.1857 .167	0.5925 .001*	0.4293 .010*	0.2364 .109	1.0000 .000*

*$p \le .05$

principal's active support and the energy education definition (rho=0.3726). Also, between other administrative and community support and energy education as a basic (rho=0.4771), a statistically significant positive correlation existed. Moreover, there were statistically significant positive correlations between teachers' interest and energy education as a basic (rho=0.6485), between teachers' interest and qualified to teach energy education (rho=0.4037), and between teachers' interest and the energy education definition (rho=0.5925). Significant positive correlations existed between energy education as a basic and qualified to teach energy education (rho=0.4124) and between energy education as a basic and the energy education definition (rho=0.4293). The null hypothesis was rejected. It was concluded that a statistically significant relationship existed between factors and the energy education definition as delineated above.

Research Question Four

Question four investigated the similarities and differences between the DOE participants and their peer teachers. The question generated nine null hypotheses. For hypotheses 4.1., 4.2., 4.3., 4.4., 4.6., 4.8., and 4.9., frequencies and chi-square statistic were computed. Whenever the expected cell frequency was less than 5.0, either Phi or Cramer's V was computed. The significance of Phi was tested by using the formula ($X^2=N\phi^2$). Then the significance level was found by using the chi-square table. The Cramer's V is significant if the chi-square is significant. For hypotheses 4.5. and 4.7., a Spearman Rank Correlation was computed. All hypotheses were tested at the $p \leq .05$ level of significance.

Question 4.

What were the similarities and differences between the DOE participants and their peer teachers?

Hypothesis 4.1. There is no significant difference between the DOE participants and the peer teachers in their previous energy education experiences.

The results of the frequency distribution and chi-square or Phi statistic are included in Table 32. The results of the chi-square analysis indicated no statistically significant difference between the 50 DOE participants and the 29 peer teachers regarding their energy experiences prior to participation in the workshop. The null hypothesis was accepted. It was concluded that a statistically significant difference did not exist between the 50 DOE participants and the 29 peer teachers regarding their prior energy education experiences.

Hypothesis 4.2. There is no significant difference between the DOE participants and the peer teachers in the kind of energy education topics included in their school curriculum before the workshop.

In Table 33 are found the results of the frequency distribution and chi-square or Phi statistic of the 50 DOE participants' and the 29 peer teachers' energy education topics in their school curriculum before their participation in the energy education workshop. The results of the chi-square or Phi statistically were not statistically significant. The null hypothesis was accepted. Therefore, it was concluded that a statistically significant difference did not exist between the 50 DOE participants' and the 29 peer teachers' energy education topics in their

TABLE 32

Frequency Distribution and Chi-Square Statistic of the 50 DOE Participants and the 29 Peer Teachers Regarding Their Prior Energy Education Experiences

Variable Label	Participants		Peers		X^2	p
	n	%	n	%		
One hour workshop	2	4.00	0	0.0	0.151[a]	0.20
Half day workshop	6	12.00	3	10.34	0.091[a]	0.50
One day workshop	6	12.00	3	10.34	0.091[a]	0.50
More than one day workshop	4	8.00	3	10.34	0.094[a]	0.50
Course on energy	7	14.00	3	10.34	0.103[a]	0.50
None	29	58.00	17	58.62	0.033	0.86
Other	12	24.00	3	10.34	0.193[a]	0.50
N	50		29		0.206[b]	
df=1						

[a] Phi

TABLE 33

Frequency Distribution and Chi-Square Statistic of the 50 DOE Participants' and the 29 Peer Teachers' Energy Education Topics in Their School Curriculum Before the Energy Education Workshop

Variable Label	Participants		Peers		X^2	*p*
	n	%	n	%		
Conventional energy	24	48.00	14	48.28	0.044	0.83
Economics of energy	11	22.00	5	17.28	0.047	0.83
Energy conservation and lifestyles	17	34.00	11	37.93	0.012	0.91
Energy and environmental interaction	15	30.00	9	31.03	0.025	0.87
Future energy alternatives	20	40.00	11	37.93	0.003	0.95
History of energy	8	16.00	5	20.69	0.029	0.86
Home energy audits	8	16.00	6	17.24	0.049	0.83
Regulation and operation of utility companies	4	8.00	2	6.90	0.020[a]	0.90
Renewable energy	14	28.00	7	24.14	0.012	0.91
Scientific principles of energy	17	34.00	8	27.59	0.116	0.73
None	9	18.00	10	34.48	1.902	0.17
Other	7	14.00	1	3.45	0.169[a]	0.20
N	50		29			
df=1						

[a] Phi

school curriculum before participation in the UMO and local inservice energy education workshops, respectively.

Hypothesis 4.3. There is no significant difference between the DOE participants and the peer teachers in the kind of energy education topics included in their 1982-1983 school curriculum.

The results of the frequency distribution and the chi-square or Phi statistic of the 45 DOE participants' and 28 peer teachers' energy education topics in their school curriculum during the 1982-1983 school year are delineated in Table 34. The chi-square for energy and environmental interaction (5.980) and for renewable energy (5.587) were statistically significant. The null hypothesis was rejected. It was concluded that there were statistically significant differences between the DOE participants and the peer teachers regarding the energy education topics included in their curriculum during the 1982-1983 school year for energy and environmental interaction and for renewable energy. Furthermore, the DOE participants taught all of the energy education topics more frequently than the peer teachers.

Hypothesis 4.4. There is no significant difference between the DOE participants and the peer teachers in the kinds of curricular materials utilized to teach energy education.

The results of the frequency distribution and chi-square or Phi statistic of the 50 DOE participants' and the 29 peer teachers' kinds of curricular materials utilized to teach energy education are presented in Table 35. The results of the chi-square statistic for business or industry produced energy education materials (6.724) and self-produced

TABLE 34

Frequency Distribution and Chi-Square Statistic
of 45 DOE Participants'[a] and 28 Peer Teachers'[b]
Energy Education Topics Included in Their School Curriculum
During the 1982-1983 School Year

Variable Label	Participants		Peers		X^2	p
	n	%	n	%		
Conventional energy	32	71.11	15	53.57	1.614	0.20
Economics of energy	24	53.33	14	50.00	0.001	0.97
Energy conservation and lifestyles	32	71.11	17	60.71	0.440	0.51
Energy and environmental interaction	29	64.44	9	32.14	5.980	0.01*
Future energy alternatives	34	75.56	20	71.43	0.014	0.91
History of energy	14	31.11	6	21.43	0.400	0.53
Home energy audits	16	35.56	8	28.57	0.131	0.72
Regulation and operation of utility companies	11	24.44	2	7.14	0.220[c]	0.10
Renewable energy	37	82.22	15	53.57	5.587	0.02*
Scientific principles of energy	27	60.00	11	39.29	2.195	0.14
None	1	2.22	0	0.00	0.093[c]	0.50
Other	4	8.89	4	14.29	-0.084[c]	0.50
N	45		28			
df=1						

[a] Included only DOE participants who are teaching in the public schools during 1982-1983.

[b] Included only peer teachers who completed this question.

[c] Phi

*$p \leq .05$

TABLE 35

Frequency Distribution and Chi-Square Statistic of the 50 DOE Participants' and the 29 Peer Teachers' Kinds of Curricular Materials Utilized to Teach Energy Education

Variable Label	Participants		Peers		X^2	p
	n	%	n	%		
Business or industry energy education materials	32	64.00	9	31.03	6.724	0.01*
Commercially produced textbooks	20	40.00	11	37.93	0.003	0.95
Films	33	66.00	12	41.38	3.590	0.06
PEEC materials	18	36.00	2	6.90	0.323[a]	0.10
Resource speaker	12	24.00	4	13.79	0.122[a]	0.30
Self-produced energy education units or materials	36	73.47	11	37.93	8.181	0.00*
Not taught	3	6.00	5	37.73	-0.180[a]	0.20
Other	5	10.00	2	17.24	0.053[a]	0.70
N	50		29			
df=1						

[a] Phi

*$p \leq .05$

energy education units or materials (8.181) were statistically significant. In addition, a significant positive relationship existed between the DOE participants and peer teachers for PEEC materials. The null hypothesis was rejected. It was concluded that there were statistically significant differences between the DOE participants and the peer teachers in their utilization of business or industry produced energy education units or materials and of self-produced energy education units or materials.

Hypothesis 4.5. There is no significant relationship between the DOE participants' and the peer teachers' in their recommendations for including energy education in the school curriculum and their curricular design.

The results of the Spearman Rank Correlation between the 50 DOE participants' and the 29 peer teachers' recommended procedures for including energy education in the school curriculum and their curricular design are included in Table 36. Statistically significant relationships were found between the DOE participants' and the peer teachers' recommendations for including energy education in the school curriculum and their curricular design for not teaching energy education (rho=0.44787), for unit within a course (rho=0.31304), for within a course but not a whole unit (rho=0.34169), and for other approaches (rho=0.42945). Even though significant relationships were found between the DOE participants' and the peer teachers' recommendations for including energy education in the school curriculum and their curricular design, there were percentage differences. There were 6% of the DOE participants and 20.7% of the peer teachers who were not teaching energy education. Also, 12% of the DOE participants and 6.9% of the peer

TABLE 36

Spearman Rank Correlation Between the 50 DOE Participants' and the 29 Peer Teachers' Recommendation for Including Energy Education in the School Curriculum and Their Curricular Design

Curricular Design	Recommendations for Including Energy Education				
	Not taught	Separate Course	Unit within a course	Within a course but not a whole unit	Other
Not Taught	0.44787	0.09278	-0.01733	0.01009	0.11272
	0.0001*	0.4161	0.8795	0.9297	0.3226
Separate course	0.22488	0.20960	0.20590	0.28400	0.30176
	0.0463*	0.0638	0.0687	0.0112*	0.0069*
Unit within a course	0.07427	0.05028	0.31304	-0.02342	0.15673
	0.5154	0.6599	0.0050*	0.8377	0.1678
Within a course but not a whole unit	0.10066	0.08833	-0.04082	0.34169	0.09860
	0.3774	0.4389	0.7209	0.0021*	0.3873
Other	0.31009	0.13758	0.13508	-0.02894	0.42945
	0.0054	0.2266	0.2352	0.8001	0.0008*

*$p \leq .05$

teachers had a separate energy education course. Moreover, 64% of the DOE participants and 34.48% of the peer teachers utilized the unit within a course approach. On the other hand, the DOE participants (36%) and the peer teachers (41.38%) were similar in their utilization of within a course but not a whole unit approach. The null hypothesis was rejected. It was concluded that statistically significant relationships existed between the DOE participants' and peer teachers' recommendations for including energy education in the school curriculum and their curricular design for not teaching energy education, for unit within a course, for within a course but not a whole unit, and for other approaches, but not for separate course approach.

Hypothesis 4.6. There is no significant difference between the DOE participants and the peer teachers in their agreement with the energy definition.

The results of the frequency distribution and the chi-square statistic of the 50 DOE participants' and the 29 peer teachers' degree of agreement with the energy education definition are found in Table 37. The chi-square was not statistically significant. The null hypothesis was accepted. Therefore, although it was concluded that a statistically significant difference did not exist between the DOE participants' and the peer teachers' in their degree of agreement with the energy education definition, it was found that the DOE participants rated the energy education definition more positively than the peer teachers.

TABLE 37

Frequency Distribution and Chi-Square Statistic of the 50 DOE Participants' and the 29 Peer Teachers' Degree of Agreement with the Energy Education Definition

Variable Label	Participants		Peers	
	n	%	n	%
Energy Education Definition				
Agree	32	64.00	12	41.38
Neutral	9	18.00	11	37.93
Disagree	9	18.00	6	20.69
N	50		29	
X^2=4.636	df=2		p=0.10	

Hypothesis 4.7. There is no significant relationship between the DOE participtants' and the peer teachers' perceptions of the factors influencing their teaching of energy education.

In Table 38 are found the results of the Spearman Rank Correlation between the factors influencing the 50 DOE participants' and the 29 peer teachers' teaching of energy education. Statistically significant positive relationships existed between principal's active support and other administrative and community support (rho=0.72558), between other administrative and community support and students' interest (rho=0.39038), and between teachers' interest and students' interest (rho=0.39394). Also, statistically significant relationships were found between teachers' interest and energy education as a basic (rho=0.46940), between energy education as a basic and students' interest (rho=0.34426), and between qualified to teach energy education and student's interest (rho=0.43809). The null hypothesis was rejected. It was concluded that a significant relationship existed between the factors influencing the DOE participants' and the 29 peer teachers' teaching of energy education as delineated above.

Hypothesis 4.8. There is no significant difference between the DOE participants' and the peer teachers' perceptions of their students' energy conservation practices and knowledge of energy-related topics.

The results of the frequency distribution and chi-square statistic of the 50 DOE participants' and the 29 peer teachers' perceptions of their students' energy conservation practices and knowledge of energy-related topics are listed in Table 39. Only the 45 DOE participants who are teaching in the public schools during 1982-1983 were included in

TABLE 38

Spearman Rank Correlation Between the Factors Influencing the 50 DOE Participants' and the 29 Peer Teachers' Teaching of Energy Education

Variable Label	Principal's Active Support	Other Administrative and Community Support	Students' Interest	Teachers' Interest	Energy Education as a Basic	Qualified to Teach Energy Education
Principal's Active Support	1.00000 0.0000*	0.72558 0.0001*	0.19363 0.1779	0.03514 0.8086	0.05816 0.6883	-0.03088 0.8314
Other Administrative and Community Support	0.72558 0.0001*	1.00000 0.0000*	0.39038 0.0051*	0.14024 0.3314	0.22013 0.1245	0.25285 0.0765
Students' Interest	0.19363 0.1779	0.39038 0.0051	1.00000 0.0000*	0.39394 0.0046*	0.34426 0.0144*	0.43809 0.0015*
Teachers' Interest	0.03514 0.8086	0.14024 0.3314	0.39394 0.0046*	1.00000 0.0000*	0.46940 0.0006*	0.15928 0.2692
Energy Education as a Basic	0.05816 0.6883	0.22013 0.1245	0.34426 0.0144*	0.46940 0.0006*	1.00000 0.0000*	0.42929 0.0019*
Qualified to Teach Energy Education	-0.03088 0.8314	025285 0.0765	0.43809 0.0015*	0.15928 0.2692	0.42929 0.0019*	1.00000 0.0000*

*$p \leq .05$

TABLE 39

Frequency Distribution and Cramer's V Statistic of 45 DOE Participants'[a] and Peer Teachers' Perceptions of Students' Energy Conservation Practices and Knowledge of Energy-Related Topics

Variable Label	Participants		Peers	
	n	%	n	%
Practices				
Inappropriate	1	2.22	2	6.90
	12	26.67	8	27.59
to	22	48.89	13	44.83
	8	17.78	5	17.24
Appropriate	2	4.44	1	3.45
N	45		29	
Cramer's V=0.120	df=4		p=0.90	
Knowledge				
Poor	2	4.44	2	6.90
	9	20.00	7	24.14
to	21	46.67	13	44.83
	11	24.44	6	20.69
Good	2	4.44	1	3.45
N	45		29	
Cramer's V=0.082	df-4		p=0.97	

[a] consisted of DOE participants who are teaching in public schools during 1982-1983.

this statistical analysis. The results of the chi-square statistic were not statistically significant. The null hypothesis was accepted. It was concluded that a statistically significant difference did not exist between the DOE participants' and peer teachers' perceptions of students' energy conservation practices and knowledge of energy-related topics.

Hypothesis 4.9. There is no significant difference between the DOE participants and the peer teachers in their utilization of traditional and non-traditional home energy sources.

The results of the frequency distribution and chi-square statistic of the 50 DOE participants and the 29 peer teachers by traditional or non-traditional primary home energy source are found in Table 40. The result of the chi-square was not statistically significant. The null hypothesis was accepted. Although it was concluded that there was no statistically significant difference between the DOE participants' and the peer teachers' primary home energy source, it was found that more DOE participants used non-traditional primary home energy sources.

Summary

Chapter IV included an analysis of the data, a restatement of the research questions and the null hypotheses, and the findings of the study in prose and tabular form.

TABLE 40

Frequency Distribution and Chi-Square Statistic
of the 50 DOE Participants and the 29 Peer Teachers
by Traditional/Non-traditional Primary Home Energy Source

Variable Label	Participants		Peers	
	n	%	n	%
Traditional	17	34.00	15	51.72
Non-traditional	33	66.00	14	48.38
Total	50		29	
X^2=1.714	df=1		p=0.19	

CHAPTER V

SUMMARY OF THE DESIGN, FINDINGS, DISCUSSION AND CONCLUSIONS, AND RECOMMENDATIONS

Chapter V includes a summary of the design, the findings, the discussion and conclusions, and the recommendations for further study.

Summary of the Design

Statement of the Problem

This study investigated the impact of the two DOE Faculty Development summer energy education workshops, sponsored by DOE and the Colleges of Education and of Engineering and Science at UMO and conducted at UMO during the summers of 1980 and 1981, on the 67 DOE workshop participants. Also, this study examined the impact of the local inservice energy education workshops, conducted by the DOE participants, on the DOE participants' peer teachers. Each DOE participant was asked to select a peer teacher who had attended his/her local inservice energy education workshop or project. The DOE participants utilized the following criteria for selecting the peer teacher: similar in subject and grade level taught, in attitude toward energy, and in number of years of teaching.

This study investigated the characteristics of both the DOE participants and their peer teachers prior to their workshop participation, the long-term effect of participation in the DOE Faculty Development summer energy education workshops at UMO on the DOE participants, the long-term effect of participation in the local inservice energy education workshops on the DOE participants' peer teachers, and the similarities and differences between the DOE participants and their peer teachers.

Need for the Study

Preston-Anderson (1982) and "Faculty Development Workshops" (1982) reported that the budget for the DOE Faculty Development Workshop Programs from 1971 through 1982 was approximately $8.5 million for 503 summer and academic year workshops. Cost-effectiveness and accountability are factors with a budget this large. Highwood et al. (1971) advocated impact studies for accountability, whereas Welch et al. (1973) and Welch (1979) advocated impact studies for planning and decision-making. Moreover, Bethel et al. (1981) recommended impact studies for cost-effectiveness. John M. Fowler at the Third Annual Practitioners Conference on Energy Education (White et al., 1980) recommended the evaluation of the impact of energy education programs. Preston-Anderson (1982) concluded that research was needed to study the long-range impact of the DOE energy education workshops in the classroom (i.e., the teaching of energy topics, curricular designs, and curricular materials).

The review of related literature found only four impact studies of energy education. Farnsworth and Gardiner (1978) studied the impact of inservice energy education on the behavior and attitudes of teachers and students during the school year directly following the energy education workshops. They used a mail questionnaire. Landes (1981) conducted an impact study of inservice energy education workshops, which focused on the energy curriculum MBTU, on the amount of time that teachers spent teaching the energy unit and on other factors such as subject and grade level taught, number of years of teaching, and the principals' attendance at the energy workshop. She used a questionnaire before the workshop, a mail questionnaire after three months of school, and a follow-up personal interview at the end of the school year. In addition, Glass (1981) investigated the impact of a NSF inservice energy education workshop on the participants' energy knowledge and attitudes toward energy. He used a pre-post and post-post (one year later) design. White et al. (1983) conducted a mail survey to study the impact of energy education curriculum in the classroom. Surveys were mailed to teachers and principals.

This study differs from the above studies in some important respects. First, this study focused on the DOE participants and on their peer teachers. Second, this study attempted to measure the impact of the treatments (i.e., either the UMO energy education workshops or the local inservice energy education workshops) one and two years after the treatments. Third, this study compared the 1980 and the 1981 DOE participants and the 1980 and the 1981 peer teachers to determine whether the implementations of energy education innovations changed as time elapsed. Fourth, this study attempted to measure the difference in the impact between the two week-long UMO workshops and the less than one day long local inservice energy education workshops on the teaching of energy topics, on the curricular designs, on the curricular materials utilized, and on the factors influencing the teaching of energy education. Fifth, this study attempted to measure the extent to which the apparent impact of the UMO workshops on the DOE participants carried through to the peer teachers.

Research Questions

This study investigated the following research questions:

1. What were the characteristics of the DOE workshop participants and of the peer teachers?

2. What effect did participation in the DOE Faculty Development summer energy education workshops at UMO have on the DOE participants?

3. What effect did participation in the local inservice energy education workshops, conducted by the DOE participants, have on the peer teachers?

4. What were the similarities and differences between the DOE participants and their peer teachers?

Summary of the Procedures

This study utilized two mail survey instruments, the EESP and the EESPT, both modifications of the 1982 Survey of Current Status of Energy Education by PEEC. Both surveys included four sections: Prior Practices Related to Energy Education, Current Practices Related to Energy Education, Factors Influencing the Teaching of Energy Education, and Background Information.

The two mailings of the surveys and the follow-up telephone call produced a total response rate of 68% (76% for the DOE participants and 60% for the peer teachers). The final usable surveys consisted of 59% (75% for the DOE participants and 43% for the peer teachers) because one EESP and seven EESPTs were returned uncompleted. Therefore, the sample consisted of 50 DOE participants and 29 peer teachers. The twenty-eight 1980 DOE participants consisted of one elementary school teacher, four middle/junior high school teachers, twenty-one senior high school teachers, and two non-teaching personnel. The twenty-two 1981 DOE participants included twelve middle/junior high school teachers, seven high school teachers, and three non-teaching personnel. The fifteen 1980 peer teachers consisted of one elementary school teacher, four middle/junior high school teachers, and ten senior high school teachers. The fourteen 1981 peer teachers consisted of one elementary school teacher, six middle/junior high school teachers, and seven senior high school teachers.

Statistical Analysis

Frequency distributions were computed for all variables. Also, the chi-square statistic was computed for all eight hypotheses of research question one; for hypotheses 2.1., 2.3., and 2.4. of research question two; for hypotheses 3.1., 3.3., and 3.4. of research question three; and for hypotheses 4.1., 4.2., 4.3., 4.4., 4.6., 4.8., and 4.9. of research question four. Whenever the expected cell frequency was less than 5.0, either Phi or Cramer's V statistic was computed. The significance of Phi was tested by using the formula ($X^2=N\phi^2$). Then the significance level was found by using a chi-square table. The Cramer's V was significant if the chi-square was significant. The $p \leq .05$ level of significance was utilized for all analyses.

The Spearman Rank Correlation was computed for hypotheses 2.2. and 2.5. of research question two, for hypotheses 3.2. and 3.5. of research question three, and for hypotheses 4.5. and 4.7. of research question four. The $\underline{p} \leq .05$ level of significance was used for all correlations.

Findings

The 1980 and the 1981 DOE participants were not significantly different in their energy education experiences and practices prior to their participation in the UMO workshops. Moreover, except for the separate course approach, the DOE participants were utilizing the curricular design which they recommended. However, before the UMO workshops, the science DOE participants tended to included scientific principles of energy in their school curriculum significantly more than the non-science DOE participants. In addition, the science DOE participants emphasized energy and environmental interaction and scientific principles of energy in their 1982-1983 school curriculum significantly more than the non-science DOE participants.

Furthermore, the 1980 and the 1981 peer teachers had similar energy education experiences and practices prior to their participation in the local inservice energy education workshops. Also, the 1980 and the 1981 peer teachers included a similar number of energy education topics in their school curriculum before and after their participation in the local inservice energy education workshops. The peer teachers' curricular designs correlated significantly with their recommended curricular designs in only two ways (i.e., for not teaching energy education and for within a course but not a whole unit approach).

Differences were found between the DOE participants and the peer teachers. The DOE participants included energy and environmental interaction and renewable energy in their 1982-1983 school curriculum significantly more than the peer teachers. Also, the DOE participants utilized significantly more business or industry produced energy education materials and self-produced energy education units than the peer teachers. In addition, it was found that except for the separate course approach, when the DOE participants and their peer teachers were grouped, they were using their recommended curricular designs for implementing energy education into the school curriculum. Moreover, a significant difference did not exist between the DOE participants and the peer teachers in their degree of agreement with the energy education definition, in their perceptions of their students' energy conservation practices and knowledge of energy-realted topics, and in their primary home energy source. The DOE participants and peer teachers perceived neither their principals' active support nor the support of administrators and community as factors that influenced their teaching of energy education.

Limitations

There are certain inherent problems in the use of a mail survey. The impersonal nature of the survey may have a negative effect upon the rate of return. Also, the DOE participants may not have adhered to the specified criteria for selecting the peer teacher. In addition, there is concern whether the DOE participant and the peer teachers completed the appropriate survey. Another factor is the accuracy of the information relating to the DOE participants' and peer teachers' energy education practices prior to their workshop participation. This information was collected one to two years after workshops participation. Also, the survey did not measure the actual amount of time devoted to teaching energy, but rather measured the number of energy topics in the DOE participants' and peer teachers' school curriculum.

If the DOE participants at UMO were representative of other energy education workshop participants, the survey instruments can be utilized to measure the impact of other energy education workshops. Also, the findings are generalizable to other middle/junior high school and secondary school energy education workshop participants who received similar energy education training and who live in a similar geographical location.

Discussion and Conclusions

This section focuses on a discussion of the findings of each research question and on the relationship of these findings to the related literature.

Research Question One

A significant difference was not anticipated between the 1980 and the 1981 DOE participants and between the 1980 and the 1981 peer teachers regarding their energy education experiences and their teaching of energy topics prior to their workshop participation and their utilization of energy education curricular materials since there were specified guidelines for selecting both the DOE participants and the peer teachers. Glass (1982) concluded that similar pretest results for the NSF workshop participants and the peer teachers seemed to indicate that the established criteria for selecting the peer teachers had been followed.

It was found that both the 1981 DOE participants and the 1981 peer teachers had participated in more energy education workshops prior to the UMO workshops; however, Barrow et al. (1983) reported that neither the 1980 or the 1981 DOE participants at UMO had participated in an extensive energy education workshop prior to the UMO workshops. In some cases, the 1981 DOE participants and the 1981 peer teachers may have taught in the same schools or school districts as the 1980 DOE participants who may have possibly stimulated interest in energy education. Also, personal conviction or an interest in energy education on the part of the 1981 DOE participants and the 1981 peer teachers may have been a major factor in their participation in energy education workshops as White et al. (1983) and Landes (1981) found. In addition, it was found that a greater number of the 1980 DOE participants had been enrolled in energy courses prior to the UMO workshops. Seventy-five percent of the 1980 DOE participants were secondary school teachers and 39.3% were secondary science teachers which may explain their greater enrollment in energy courses prior to the UMO workshops.

Also, the 1981 DOE participants more often than the 1980 DOE participants taught economics of energy, energy conservation and lifestyles, energy and environmental interaction, future energy alternatives, history of energy, home energy audits, regulation and operation of utility companies, renewable energy, and scientific principles of energy before the UMO workshop. Landes (1981) found that previous energy education workshop participation favorably influenced the teachers' teaching of energy topics. Also, in those cases where the 1980 DOE participant and the 1981 DOE participant taught in the same school or same school district the 1980 DOE participant may have encouraged the 1981 DOE participant to teach energy education. Another explanation may be the great preponderance of middle/junior high school science teachers (31.8%) in the 1981 UMO workshop. These teachers would be teaching General Science which may include many of these energy topics.

The 1980 DOE participants more frequently than the 1981 DOE participants taught conventional energy and other energy topics or chose not to teach energy education. Those who did not teach energy before the UMO workshops may not have participated in any energy education workshops or energy courses before their workshop participation. Conventional energy is more frequently covered in textbooks than the other energy topics. Therefore, these results may suggest that the 1980 DOE participants of which 75% were secondary school teachers relied heavily on textbook coverage of energy prior to their workshop participation.

Furthermore, both the 1980 and the 1981 DOE participants unanimously agreed that the principal did not influence their teaching of energy education. Likewise, Landes (1981) and White et al. (1983) found that teachers did not attribute their teaching of energy education to their principal's support. Edmonds' (1982) school effectiveness research delineated the principal as the instructional leader of the school as one of the five characteristics of an effective school. On this basis, one could conclude that the DOE participants at the UMO workshops did not perceive their principals as instructional leaders in the area of energy education.

Research Question Two

The 1981 DOE participants more frequently taught conventional energy, economics of energy, energy conservation and lifestyles, energy and environmental interaction, future energy alternatives, home energy audits, renewable energy, and principles of energy while the 1980 DOE participants more frequently taught history of energy, regulation and operation of utility companies, and other energy topics. Since both groups received similar training at UMO, other factors must have contributed to the difference. Garey et al. (1980), Landes (1981), and White et al. (1983) found that personal conviction was a primary motivation for teaching energy education. Landes (1981) advised that previous workshop participation influenced the teaching of energy education. This study found that the 1981 DOE participants had participated in more energy education workshops prior to the UMO workshops; therefore, they had more workshop experience. Another possible factor is the amount of time that has elapsed since the UMO workshops. It has been found that the impact of innovations decreases after two years. Therefore, one would expect that the 1981 DOE participants would be teaching more energy topics than the 1980 DOE participants. Also, 31.8% of the 1981 DOE participants were middle/junior high school science teachers who perhaps would have the flexibility in their curriculum to infuse energy topics. Also, it was found that the 1980 and the 1981 DOE participants at UMO emphasized energy topics similar to those teachers who responded to the Survey of the Current Status of Energy

Education (White et al., 1983). The DOE participants placed the greatest emphasis upon these topics: renewable energy (82%), future energy alternatives (75%), energy conservation and lifestyles (71%), conventional energy (71%), and energy and environmental interaction (64%). The UMO workshops emphasized these topics. Also, more than half of the DOE participants at UMO were science teachers as was the case in the respondents to the Survey of the Current Status of Energy Education. Therefore, similar results should be expected. These results seemed to suggest that the DOE participants at UMO were reprsentative of other teachers.

The DOE participants were utilizing their recommended curricular designs except for the separate course approach. Sixty-four percent used the unit within a course approach which was greater than White et al.'s (1983) finding of 33%. The DOE participants at UMO both adapted and developed energy education units as part of their workshop experience which seemed to have had a positive impact on their curricular design. In addition, 36% of the DOE participants utilized the within a course but not a whole unit approach as their curricular design. White et al. (1983) reported 66% for this approach. Another important difference is the DOE participants' recommendation for a separate energy course (24%) and their utilization of this approach (12%). This recommendation seemed to suggest a deep personal conviction to teach energy education which perhaps may be thwarted by the rigidity of the school curriculum or by the school budget. The school districts may not consider energy education as a basic; therefore, the school budget would not provide funds for energy education. Presently, educators are being confronted with a movement to return to the basics. Some people may consider energy education not as a basic but just a fad or frill in the school curriculum.

Significant differences in favor of the science DOE participants existed for the teaching of scientific principles of energy both before and after the UMO workshops and the teaching of energy and environmental interaction after the UMO workshops. In addition, the science DOE participants seemed to teach all energy topics except the history of energy regulation and operation of utility companies, and other energy topics more than the non-science teachers. Why would these differences occur? Most of these topics are frequently classified as science topics. Also, if these topics are to be found in textbooks, probably they would be found more frequently in science textbooks. In addition, science as a discipline has begun to focus on science, technology, and society under which many of these topics could be classified. These results supported White el al.,s (1983) findings that secondary science teachers ranked energy and environmental interaction (75%) and scientific concepts (69%) high. Another factor that may account for the differences is the workshop instruction. Most of the UMO workshop professors had a science background. These findings seemed to suggest that the UMO workshops had a greater impact on the science DOE participants. Also, Moore (1981) reported that third year and beyond science majors outperformed other college students on the knowledge section of the Energy Inventory. Therefore, it may be surmised that science teachers have a better understanding of energy, and therefore, are better prepared to teach energy topics and more comfortable teaching energy education.

Research Question Three

The peer teachers' curricular designs correlated significantly with their recommended curricular designs in only two ways (i.e., for not teaching energy education and for the within a course but not a whole unit approach). It was found that 20.7% of the peer teachers were not teaching energy education and that 41.5% were utilizing the within a course but not a whole unit approach. In addition, although 62.1% of the peer teachers recommended the unit within a course approach, only 34.5% of them used this approach. The peer teachers seemed to be similar in curricular design to the teacher respondents to the PEEC survey (White et al., 1983). These results were expected. The peer teachers participated in the local inservice energy education workshops which were no more than one day in duration. The purpose of these local inservice workshops was awareness and dissemination of energy education materials whenever possible. The peer teachers did not experience energy education curriculum development in the local inservice energy education workshops. Questions arise. Would the peer teachers be utilizing the unit within a course curricular design more frequently if they had attended the UMO workshops which focused on adapting and developing energy education curricular materials? Also, should the local inservice energy education workshops be formulated to deal with curriculum design and development?

Although statistically significant differences were not found between the science and non-science peer teachers, it was found that the science peer teachers were teaching more energy topics except for conventional energy and home energy audits more than the non-science peer teachers after the local inservice energy education workshops.

This was expected because most of the energy education topics are related to science. White et al. (1983) found that secondary science teachers ranked energy and environmental interaction and scientific principles of energy high.

As with the DOE participants, the peer teachers did not perceive the principal's active support as a factor that influenced their teaching of energy education.

Research Question Four

Although significant differences did not exist between the DOE participants and the peer teachers regarding their prior energy education experiences, it was found that the DOE participants had attended more energy education workshops and courses on energy before their workshop participation than the peer teachers. This seemed to indicate that the DOE participants had a deeper commitment to energy education prior to the workshops. In addition, before the energy education workshops, the DOE participants emphasized the economics of energy, future energy alternatives, regulation and operation of utility companies, renewable energy, and scientific principles of energy slightly more than the peer teachers, whereas the peer teachers focused on conventional energy, energy conservation and lifestyles, energy and environmental interaction, history of energy, and home energy audits slightly more than the DOE participants. These differences in emphasis were minimal.

During the 1982-1983 school year which was one and two years after the UMO workshops, the DOE participants included energy and environmental interaction in their school curriculum significantly more than the peer teachers. Moreover, the DOE participants taught all energy topics more frequently than the peer teachers after their workshop participation. Since a significant difference did not exist between the DOE participants and the peer teachers concerning the energy education topics in their school curriculum prior to their workshop participation, it has been concluded that the UMO workshops made a difference. The DOE participants participated in the UMO workshops which were approximately two weeks in duration as opposed to the local inservice energy education workshops of one day or less in duration. The UMO workshops focused on the scientific, technological, and economic aspects of wood, solar, hydroelectric, nuclear energy, and natural gas; on energy education curriculum materials; and the development of energy education curricular units. The local inservice energy education workshops focused on energy awareness, but did not have a consistent format from workshop to workshop. The local inservice energy workshops included energy fairs, exhibits of energy education materials, assembly programs, lectures, seminars, and other kinds of energy education activities. These differences seemed to suggest that energy education workshops should have an established format and program and should consist of more than a one day workshop. Another possible factor is the difference in subject area. Only 41.4% of the peer teachers were science teachers, whereas 54% of the DOE participants were science teachers. White et al. (1983) found that science teachers tended to emphasize energy topics more than non-science teachers.

Furthermore, the DOE participants used business or industry produced energy education materials and self-produced energy education units or materials significantly more than their peer teachers. In fact, the DOE participants utilized all energy education curricular materials more than the peer teachers. Also, it was found that the DOE participants at UMO used business or industry produced energy education materials, films, PEEC materials, and self-produced energy education units or materials more than the PEEC survey respondents (White et al., 1983). White et al. (1983) found that secondary teachers depended heavily upon business or industry produced energy education materials. If this were true for this study, the peers should have surpassed the DOE participants in their use of business or industry produced energy education materials since 93% of the peer teachers as opposed to 88% of the DOE participants were middle/junior or senior high school teachers. White et al. (1983) reported that 61% of the secondary teachers utilized self-produced energy education units or materials. This study found that 73.47% of the DOE participants and 37.93% of the peer teachers used self-produced energy education units or materials. These results seemed to suggest that participation in the UMO workshops may have been the primary factor for the differences since the DOE participants were exposed to many different kinds of energy education materials and to different approaches to energy issues. Also, the DOE participants were involved in adapting and developing energy education units and materials. They were responsible for writing the overview, teacher background information, and student activities for the ABC's of Energy (Barrow et al., 1982). Therefore, the DOE participants had experience in energy education curriculum development. This significant difference between the DOE participants and the peer teachers seemed to suggest that the UMO workshops influenced the DOE participants' utilization of curricular materials.

The DOE participants and the peer teachers were using their recommended curricular designs for including energy education in the school curriculum except for the separate course approach. The results of this study found that the DOE participants and peer teachers approached energy education differently. The DOE participants (12%) and the peer teachers (6.9%) utilized the separate course approach which seemed to suggest that the DOE participants implemented energy education as a separate course more frequently than the peer teachers. The DOE participants (64%) and the peer teachers (34.48%) utilized the unit within a course approach. This difference was anticipated because the DOE participants were exposed to energy education infusion units and adapted or developed energy education units at the UMO workshops, whereas the peer teachers were not involved in curriculum development at the local inservice energy education workshops. Also, the DOE participants (36%) and the peer teachers (41.38%) utilized the within a course but not a whole unit course approach. This apapproach does not represent as much commitment to energy education as the two previous approaches. Also, there was a difference between the DOE participants (6%) and the peer teachers (20.69%) in their decision not to teach energy education. These results seemed to suggest a greater commitment on the part of the DOE participants. After all, it was the DOE participants who chose to attend a two week-long energy education workshop, not the peer teachers. Also, the differences seemed to indicate that the training at UMO provided the DOE participants with the skill and knowledge to do a more thorough job in their classrooms.

Also, these results seemed to suggest that training in energy education curriculum development can bring about change.

The DOE participants and the peer teachers were similar in their perceptions of their students' energy conservation practices and knowledge of energy-related topics, and in their primary home energy heating source. In addition, although the DOE participants and peer teachers were not significantly different in their degree of agreement with the energy definition, it was found that the DOE participants rated the energy definition more favorably than the peer teachers. It has been concluded that the DOE participants may have a greater understanding of the complexity of the energy dilemma which could suggest that the UMO workshops had a positive effect on the DOE participants regarding their attitudes toward the energy crisis.

Furthermore, the DOE participants and the peer teachers did not perceive the principal's active support and other administrative and community support as factors that influenced their teaching of energy education. These findings supported both Landes (1981) and White et al. (1983). White et al. (1983) reported that teachers indicated a lack of support from their principals, whereas the principals suggested that teachers refrained from teaching energy education because the teachers felt unqualified to teach energy education. Edmonds (1982) would argue that neither the DOE participants nor the peer teachers perceived the principals as instructional leaders in the area of energy education.

Summary of the Discussion and Conclusions

It was concluded that the DOE workshops at UMO had a positive effect on the DOE participants' teaching of energy education, on their curricular designs, and on their utilization of energy education curricular materials. Also, the DOE participants through the local inservice energy education workshops and through other contact with the peer teachers seemed to have had a positive effect on the peer teachers' teaching of energy education topics. The DOE participants increased the number of all energy topics after their workshop participation. Except for conventional energy and energy and environmental interaction, the emphasis of these topics carried through to the 1980 peer teachers' teaching of energy topics. Also, the 1981 DOE participants' emphasis of these energy topics seemed to have penetrated the 1981 peer teachers' teaching of energy topics except for regulation and operation of utility companies. However, when the DOE participants and the peer teachers were compared, the DOE participants surpassed the peer teachers in the number of energy education topics that they taught, in their utilization of the unit within a course and the separate course curricular designs, and in their use of energy education curricular materials. The results of this study seemed to suggest that the UMO workshops were needed. Also, the difference between the DOE participants and peer teachers seemed to suggest that the workshops of longer duration with a specified format are more effective than the workshops of one day or less in duration in bringing about change in the teaching of energy topics, curricular design, and utilization of curricular materials. In addition, the difference between the 1980 and the 1981 DOE participants seemed to suggest that implementation of innovations decreased as time elapsed. Also, the "Back to Basics" movement may have curtailed the DOE participants' and the peer teachers' teaching of energy topics. Over the past year, energy educators have faced another hurdle concerning the importance of energy education as the Federal Government withdrew its support for energy education programs. To some people, this lack of support from the Federal Government is an omen that energy education is a passing fad. Therefore, energy educators should be prepared to explain why energy education is a basic which should be infused into the existing school curriculum.

Recommendations

From this study, which investigated the characteristics of the DOE participants prior to the UMO workshops and of the peer teachers prior to the local inservice energy education workshops, the impact of the UMO workshops on the DOE participants, the impact of the local inservice energy education workshops on the peer teachers, and the similarities and differences of the DOE participants and the peer teachers, the following recommendations for further research emerged. These recommendations were derived from the researcher's experiences in conducting this study, from the findings and conclusions, and from the implications of the conclusions.

Preservice and Inservice Energy Education

Landes (1981) and White et al. (1983) identified personal conviction as a major factor in deciding to teach energy education. Also, this study found that science teachers included more energy topics in their school curriculum than non-science teachers. White et al. (1983) found that secondary science teachers ranked energy and environmental interaction and the scientific principles of energy high. Moore (1981) concluded that third year and beyond college science majors surpassed beginning science and other college majors on the knowledge section of the Energy Inventory. Several questions surfaced. Are science teachers different than non-science teachers, or is the nature of science different than other disciplines? Does science education provide a structure of knowledge and the scientific method which gives the science teachers confidence to deal with the complexities of the energy issues as delineated in this study's energy education definition? Do non-science teachers perceive the energy issues as only science related? Since the energy dilemma appears to be a perennial problem, and since science teachers seem to teach more energy education, should all preservice teachers be required to take more science courses or should all preservice teachers enroll in an energy education course? Perhaps both are necessary. Therefore, energy educators should identify effective teaching strategies for teaching energy education to preservice teachers. Glass (1982a) identified the characteristics of an ideal K-12 energy education program. He emphasized energy literacy and the interdisciplinary approach. The preservice energy educators must identify the what, why, and how of energy education. The preservice teacher should receive training in energy education through either a separate course approach or a unit within a general education methods course. The course should focus on the scientific, political, economic, technological, environmental, ethical, and social aspects of energy exploration, production, conversion, transportation, and use. This preservice energy education should include utilization of infusion units since this approach seems to be a practical approach for implementing energy education into the K-12 school curriculum. The preservice teacher could learn how to use energy education infusion units by microteaching. Ideally, the preservice teacher should learn how to adapt, design, and develop energy education curricular materials. Preservice education is preventive education. With the introduction of preservice energy education, less time and money should have to be spent on inservice energy education.

Until preservice teachers receive energy education, inservice energy education appears to be the most effective strategy for dealing with energy issues. Landes (1981), Dunlop et al. (1981), Glass (1981), Barrow (1982), Riley et al. (1982), Glass (1982), Barrow et al. (1983) found that inservice energy education workshops had a significant positive effect upon the participants' attitudes toward the energy dilemma and upon the knowledge level of energy-related issues. Two questions arise. How have these changes in energy attitudes and energy knowledge affected the school curriculum? If changes have occurred, were they long-term or short-term? To study the impact of inservice energy education workshops, it is recommended that future studies have the participants complete a pre-survey, a survey one year later, and another survey two or more years later. The pre-survey would provide a more accurate assessment of the participants' prior energy education practices. This would indicate whether periodical follow-up inservice workshops are needed to perpetuate the energy education innovations. Also, there is a need to find an accurate and meaningful way to measure the exact time teachers spend teaching energy education. Also, there is need to compare the energy education workshop participants with peer teachers who are unlike the participants in attitude toward energy. It is recommended that a naturalistic approach, using the personal interview, be utilized in this research.

Does the dynamics of the energy education workshop affect the outcome? There is need to focus on the dynamics of the workshop (i.e., the instructors, guest speakers, curricula, teaching strategies, classroom atmosphere, goals, work load, and biases). The researcher has designed her paradigmatic inservice energy education workshop. The workshop should consist of approximately four weeks of in residence energy education. The instructors should represent many disciplines, but especially science, technology, history, economics, and sociology or psychology since the energy issues are complex. Also, it would be important to have a cross section of teachers and administrators as participants to assure implementation of energy education in the schools. Also, a letter that clearly defines the purpose of the workshop and of ancillary activities and responsibilities of the participants should be mailed to the participants at the time of acceptance into the workshop. The participant should receive at least 6 credit hours for completing the workshop successfully. This workshop should focus on the scientific, environmental, economic, political, technological, ethical, and social aspects of energy exploration, production, conversion, transportation, and use. Also, it should expose the participants to curriculum design and curriculum materials. The participants would learn how to adapt and develop energy education curricular materials. Also, they would teach their units to other participants. The participants would be instructed to use all modalities of learning and to get the students involved in activities.

Factors Influencing the Teaching of Energy Education

In addition to preservice and inservice education, what other factors may affect the teacher's decision to teach energy education? This study and Landes (1981) found that the teachers perceived energy education workshops as a positive influence in their decision to teach energy education, but did not find the principal's support as a motivating influence. Edmonds (1982) argued that the principal as an instructional leader is an essential characteristic of an effective school. Therefore, future energy education research should investigate the impact of energy education workshops in schools identified as effective as opposed to those identified as ineffective. This research would focus on the dynamics of the total school system and community.

Since this study focused on only the DOE participants' and peer teachers' perceptions and practices, perhaps further research should investigate the perceptions and practices of the school principals and the students. Both mail surveys and personal interviews could be used to obtain the information.

Another factor that should be examined is the impact of the participants' reason(s) for attending the energy education workshop on the participants' teaching of energy education after the workshop. Garey et al. (1980) found that participants identified the following reasons for their DOE workshop participation: desire to learn more about energy resources and problems, and to obtain ideas, materials, and information for teaching energy. Do other factors such as a need for recertification, a free course, or time away from home influence participation in energy education workshops? If so, do these participants treat energy education in the same way as those who are motivated to learn about energy issues?

In addition, since White et al. (1983) found that 66% of the survey respondents used self-produced energy education materials and since this study found that 73.47% of the DOE participants and 37.93% of the peer teachers used self-produced energy education materials, there is need to investigate why teachers are utilizing self-produced energy education materials. Also, it is important to measure the degree of bias in business or industry produced energy education materials since this study as well as White et al. (1983) found that teachers often utilized these materials in teaching energy education.

Furthermore, one should consider the impact of the recent oil glut on energy education. Is energy education needed, or is it simply another educational fad that is here today and gone tomorrow? We have experienced both energy prosperity and energy despair during this century. As energy educators, we should consider the synergistic effect of all factors that influence the teaching of energy education and should begin to focus on preventive energy education so that we can avoid a repeat of the bleak seventies.

Another factor that is confronting energy educators as well as other educators is the "Back to Basics" movement. Because of decreased Federal and State aid to education, energy educators should be prepared to defend the need for energy education in the schools. The energy educator should focus on the infusion approach for the implementation of energy education. Also, energy educators should emphasize that energy education is a basic since energy is a basic need of all.

Summary of the Recommendations

Further research on the impact of and implementation of energy education should focus on preservice and inservice education and on the factors that influence the teaching of energy education.

REFERENCES

REFERENCES

Agne, Russell, Conrad, D., & Nash, R. J. The science teacher as energy analyst and activist. The Science Teacher, 1974, 41(8), 12-17.

Allen, Rodney F., & LaHart, David E. Environmental/energy education: An ethical perspective. The American Biology Teacher, 1979, 41 (6), 349-353.

Barrow, Lloyd H. Energy knowledge and attitudes and locus of control of secondary teachers. Paper presented at the fifty-fifth annual meeting of the National Association for Research in Science Teaching, Lake Geneva, Wisconsin, April 1982.

Barrow, Lloyd H., & Bitner, Betty L. (Eds.). ABC's of energy. Orono, ME: College of Education, University of Maine, 1981.

Barrow, Lloyd H., & Hodgdon Ed (Eds.). ABC's of energy, draft. Orono, ME: College of Education, University of Maine, 1981.

Barrow, Lloyd H., & Holden, Constance C. Energy knowledge and attitudes and locus of control of secondary teachers: Study ii. A paper presented at the fifty-sixth annual meeting of the National Association for Research in Science Teaching, Dallas, Texas, April 1983.

Bauman, Paul C., & Petrock, Edith M. Energy education: Why, what and how. Denver, CO: Education Improvement Center, Education Commission of the States, 1981. (ERIC Document Reproduction Services No. Ed 211 347)

Berty, Ernest. Ye olde maile survey. Charleston, WV, 1979. (ERIC Document Reproduction Service No. ED 177 710)

Bethel, Lowell J., & Hord, Shirley M. A case study of change: Inservice teachers in a national science foundation environmental science education program. Washington, D.C.: National Institute of Education and National Science Foundation, 1981. (ERIC Document Reproduction Service No. ED 200 589)

Boyer, Ernst L. Special feature on energy and the schools. Today's Education, 1977, 66(3), 55-58.

Buethe, Chris. Energy in your curriculum. Educational Leadership, 1979, 37(2), 162-164.

Buethe, Chris. Editorial, Energy education is here. Contemporary Education, Winter 1981, 52(2), 69.

Champagne, Audrey B., & Klopfer, Leo E. *Criteria for effective energy education*. Pittsburgh University, PA: Learning Research and Development Center, 1977. (ERIC Document Reproduction Service No. ED 155 066)

Coon, Herbert L., & Disinger, John P. *Energy education programs, high school programs and resources*. Columbus, OH: ERIC Information Analysis Center for Science, Mathematics, and Environmental Ecucation; Washington, D.C.: Energy and Education Action Center, 1979. (ERIC Document Reproduction Service No. ED 183 381)

Crater, Harold L., & Mears, David E. Evaluating attitudes toward, and knowledge of, energy problems in the eighth grade. *School Science and Mathematics*, 1981, *81*(2), 121-123.

Directory of energy education materials. *Energy & Education*, April 1982, *6*(4), pp. 1-8.

Downie, N. M., & Heath, R. W. *Basic statistical methods* (3rd ed.). New York: Harper & Row, 1970.

Duggan, Donald D. Energy education and the three c's. *Science and Children*, 1978, *15*(6), 7-12.

Duggan, Donald D. Past, present, and future energy education, a federal perspective. *Contemporary Education*, Winter 1981, *52*(2), 70-72.

Dunlop, David L., & Fazio, Frank. *The effects of a one-day energy workshop on science teachers' attitudes toward energy-related topics*. 1981. (ERIC Document Reproduction Service No. ED 201 490)

Eckenrod, James S. *Energy in the social studies curriculum: Accommodation or assimilation?*, 1980. (ERIC Document Reproduction Service No. ED 199 140)

Edmonds, Ronald R. On school improvement: A conversation with Ronald Edmonds. *Educational Leadership*, 1982, *40*(3), 12-15. (a)

Edmonds, Ronald R. Programs of school improvement: An overview. *Educational Leadership*, 1982, *40*(3), 4-11. (b)

Energy Assistance Office. *Teacher energy education survey*. Columbus, OH: Ohio State Department of Education, 1981. (ERIC Document Reproduction Service No. ED 204 175)

Energy Commission of the States. *The status of state energy education policy*. Denver, CO. 1979. (ERIC Document Reproduction Services No. ED 176 969)

Energy Information Associates, Inc. *The status of state energy education policy. Final report*. Littleton, CO, 1978. (ERIC Document Reproduction Service No. ED 162 890)

Energy 80 Project. Survey. *Energy Ed*, 1980, *1*(1), 8.

Enterprise for Education. A conceptual framework for energy education, K-12. Santa Monica, CA: Enterprise for Energy, 1982. (Available from NTIS, U.S. Department of Commerce, Springfield, VA)

Faculty development workshops. *Energy & Education*, March 1982, *5*(3), pp. 5-8.

Farnsworth, Briant J., & Gardner, Janet. Helping to solve the energy problem through in-service training. *College Student Journal*, 1978, *12*(3), 282-285.

Fazio, Frank, & Dunlop, David L. *The development and use of an energy environment assessment instrument*. 1977. (ERIC Document Reproduction Service No. ED 135 664)

Forte, Theodore. Come here and sic em! A speech presented at the Northern Penobscot Regional Reading Association, Mattanawcook Academy, Lincoln, Maine, March 1983.

Fowler, John M. Entering a new energy age. *The Science Teacher*, 1975, *42*(8), 32-38.

Fowler, John M. The energy elephant. *The Journal of College Science Teaching*, 1977, *7*(2), 95-97.

Fowler, John M. Energy the surprising decade. *The Science Teacher*, 1983, *50*(3), 37-47.

Garey, Robert B., & Preston-Anderson, Andrea. The DOE faculty development program: An evaluation. (DE-AC05-760R0003). Oak Ridge, TN: Labor and Policy Studies Program Manpower Education, Research, and Training Division Oak Ridge Associated Universities, September 1980. (NTIS No. ORAU-164)

Gierke, C. David. Energy education: Teaching for the future. *Man/Society/Technology*, 1978, *37*(8), 6-9.

Glass, Lynn W. Outcomes of an energy education workshop for secondary school science teachers. *School Science and Mathematics*, 1981, *81*(6), 496-502.

Glass, Lynn W. Energy education: The desired state. Unpublished manuscript, Iowa State University, 1982. (a)

Glass, Lynn W. An inservice energy education program for elementary school teachers. *Journal of Research in Science Teaching*, 1982, *19*(6), 469-474. (b)

Glass, Lynn W., & Hofman, Helenmarie. *Relationships between student attitudes toward selected energy issues and teacher and student perceptions of quality of the PEEC unit coal*. Paper presented at fifty-third annual meeting of the National Association for Research in Science Teaching, Boston, MA, April 1980.

Greenwald, M., & Hahn, Marshall. Energy education-our mandate. *Man/Society/Technology*, 1977, *36*, 214-217.

Hickman, F. M. Energy and society investigations in decision making formative evaluation report. *BSCS Newsletter No. 67*, 1977, pp. 7-17.

Highwood, Joyce E., & Mertens, Thomas R. Evaluations of NSF summer institutes. *The American Biology Teacher*, 1972, *34*(4), 215-221.

Hofman, Helenmarie H., & Miller, F. Gene (Eds.). *Second annual practitioners conference on energy education proceedings*. Washington, D.C.: National Science Teachers Association, 1979. (ERIC Document Reproduction Service No. ED 187 550)

Holden, Constance C., & Barrow, Lloyd L. *Validation of the test of energy concepts and values for high school students*. Paper presented at the fifty-fifth annual meeting of The National Association for Research in Science Teaching, Lake Geneva, Wisconsin, April 1982.

Holmes, Barbara. Energy: *Knowledge and attitudes, a national assessment of energy awareness among young adults*. Education Commission of the states, Denver, CO: National Assessment of Educational Progress, 1978. (ERIC Document Reproduction Service No. ED 166 017)

Horvat, R. E. Back to basics: The abc's of energy. *NASSP Bulletin*, 1978, *62*(419), 1-7.

Hounshell, Paul B., & Liggett, Larry. Environmental education one year later. *Journal of Environmental Education*, 1976, *8*(1), 32-35.

Hull, C. Hadlai, & Nie, Norman H. *SPSS update 7-9 new procedures and facilities for releases 7-9*. New York: McGraw-Hill Book Company, 1981.

Inservice education. *Practical Applications of Research*, Bloomington, IN, 1983, *5*(3), pp 1-4.

James, Robert K. *Teachers concerns and their implementation of energy education*. Paper presented to the fifty-fifth annual meeting of the National Association for Research in Science Teaching, Lake Geneva, Wisconsin, April 1982.

Jones, Robert M., & Steinbrink, John E. *A survey of precollege energy education curricula at the state level*. 1977. (ERIC Document Reproduction Service No. ED 155 018)

Kastrinos, William. Summer institute - a follow-up. *The American Biology Teacher*, 1967, *29*(8), 620-621.

Kerlinger, Fred N. *Foundations of behavioral research* (2nd ed.). New York: Holt, Rinehart and Winston, Inc., 1973.

Kielbowick, David P. *Sex as a factor in relating the words used in describing the energy crises to the cognition of figural preception transformations*. A paper presented at the fifty-fifth annual meeting of the National Association for Research in Science Teaching, Lake Geneva, Wisconsin, April 1982.

Koballa, Thomas Jr. *Designing a likert-type scale to assess attitude toward energy conservation*. A paper presented at the fifty-fourth annual meeting of the National Association of Research in Science Teaching, Catskills, NY, April, 1981.

Kohl, Jerome. Utilization of existing energy teaching materials. *Journal of Environmental Education*, Spring 1981, *12*(3), 29-35.

Kooi, Warren James. *An analysis and evaluation of the NSTA energy education materials produced by PEEC*. Morgantown, WV: West Virginia University, 1979. (ERIC Document Reproduction Service No. ED 178 320)

Kuhn, David J. Teaching the energy lesson. *The Science Teacher*, 1978, *45*(6), 32-33.

Kuhn, David J. Energy education: Preparing people for the future. *Illinois Schools Journal*. Fall, 1979, *59*(3), 15-23. (a)

Kuhn, David J. Study of the attitudes of secondary school students toward energy-related issues. *Science Education*, 1979, *63*(5), 609-620. (b)

Landes, Nancy Marie. *An evaluation of the implementation of energy education curricula in selected classrooms (K-8)*. (Doctoral dissertation, Michigan State University, 1981)

Maine Office of Energy Resources. *Energy education teacher needs assessment report*. Augusta, ME: State House Station 53, June 1981.

McLeod, Richard, Hetherington, Martin, & Treagust, David. Instilling the energy ethic-activities to live by. *The Science Teacher*, 1980, *47*(2), 36-37.

Miller, Janet L., & others. *Review and evaluation of DOE energy education curriculum materials*. Columbus, OH: Battelle Memorial Institute, 1979. (ERIC Reproduction Service No. ED 179 423)

Minnesota State Energy Agency. *Energy education materials bibliography, K-12, 1980 second edition*. St. Paul, MN, 1980. (ERIC Document Reproduction Service No. ED 200 423)

Moore, H. Kent. Energy related information - attitude measures of college-age students. Journal of Environmental Education, 1981, 12, 30-33.

Murphy, Elaine, & Dahlin, Marjorie. The zero population growth population education program: a formal evaluation of the 1975-1976 project and current progress. Washington, D.C.: Zero Population Growth, Inc. (ERIC Reproduction Service No. ED 153 862)

National Assessment of Educational Progress. Selected results from the national assessments of science: Energy questions. Washington, D.C.: National Center for Education Statistics, 1975. (ERIC Document Reproduction Service No. ED 127 203)

National School Boards Association. Energy education and the school curriculum. Research report, 1980-1982. Washington, D.C.: 1980. (ERIC Document Reproduction Service No. ED 199 091) (a)

National School Boards Association. Youth awards program for energy achievements. Washington, D.C. (DE-AP01-801R11119), January 1980. (b)

Network names state contacts. Energy & Education, February 1983, 6(3), p. 3.

Nie, Norman, H., Hull, C. Hadlai, Jenkins, Jean G., Steinbrenner, Karin, & Bent, Dale H. (Eds.). SPSS statistical package for the social sciences (2nd ed.). New York: McGraw-Hill Book Company, Inc., 1975.

Norusis, Marija J. SPSS introductory guide: Basic statistics operations. Chicago, IL: McGraw-Hill Book Company, 1982.

Ost, David H. An evaluation of an institute for teachers of secondary school biology. The American Biology Teacher, 1971, 33(9), 546-548.

Pearl, Richard E. The present status of science attitude measurement: History, theory, and availability of measurement instruments. School Science and Mathematics, 1974, 74, 374-381.

Perry, Carol M. Energy education is not. . . In Michael J. McClelland (Ed.), Energy Information Sourcebook, Michigan Department of Commerce: Energy Administration, 1982.

Petrock, Edith. Policy issues in K-12 energy education. Denver, CO: Education Commission of the States, 1979.

Preston-Anderson, Andrea. Faculty development: An assessment of 1981 summer workshops (DE-AC05-760R00033). Oak Ridge, TN: Assessment and Field Support Program Manpower Education, Research, and Training Division Oak Ridge Associated Universities, February 1982. (NTIS No. ORAU-196)

Publication manual of the american psychological association, (2nd ed.). Washington, D.C.: American Psychological Association, 1974.

Ray, Alice Allen (Eds.). SAS user's guide: basics (1982 ed.). Cary, NC: SAS Institute Inc., 1982.

Ray, Alice Allen (Ed.). SAS user's guide: statistics (1982 ed.). Cary, NC: SAS Institute Inc., 1982.

Richardson, W. D., & Johnson, Linda. Measuring teachers' attitudes about energy and related subjects. Paper presented at the fifty-third annual convention of the National Association for Research in Science Teaching, Boston, April 1980.

Riley, Joseph P. II, & Waugh, Michael. The development and use of energy knowledge and attitude tests from released national assessment items. A paper presented at the fifty-fifth annual meeting of the National Association of Research in Science Teaching, Chicago, IL, April 1982.

Shafer, Rudy. The dung heap syndrome and other destructive phenomena detrimental to the progress of environmental education. Journal of Environmental Education, Fall 1979, 11, 4-5.

Steinbrink, John E., & Jones, Robert M. Humanistic learning environments: The development of a local energy institute model. Contemporary Education, Winter 1981, 52(2), 93-96. (a)

Steinbrink, John E., & Jones, Robert M. The shared local resources energy institute model. 1981. (ERIC Document Reproduction Service No. ED 210 170) (b)

Strunk, William, Jr. & White, E. B. The elements of style (3rd ed.). New York: Macmillan, 1979.

Weaver, Kenneth F. America's thirst for imported oil, our energy predicament. National Geographic, February 1981, pp. 2-5; 16-19; 22-23.

Weinberg, Sharon L., & Goldberg, Kenneth P. Basic statistics for education and the behavioral sciences. Boston: Houghton Mifflin Company, 1979.

Welch, Wayne W. Five years of evaluating federal programs - implications for the future. Science Education, 1979, 63(3), 335-344.

Welch, Wayne W., & Gullickson, Arlen R. A strategy for evaluating the NSF comprehensive program for teacher education. School Science and Mathematics, 1973, 73, 759-767.

White, Janet A. 4th annual practitioners conference on energy education. National Science Teachers Association, Washington, D.C., December 10-12, 1981.

White, Janet A., & Fowler, John M. Energy education in the schools. Results of a survey of the penetration of energy education into the classroom. National Science Teachers Association, Washington, D.C.: Project for an Energy-Enriched Curriculum, January 1983.

White, Janet A., & Hofman, Helenmarie (Eds.). Third annual practitioners conference on energy education. National Science Teachers Association, Washington, D.C.: Project for an Energy-Enriched Curriculum, November 13-15, 1980.

Willson, Victor L., & Garibaldi, Antoin, M. The association between teacher participation in NSF institutes and student achievement. Journal of Research in Science Teaching, 1976, 13(5), 431-439.

APPENDICES

APPENDIX A

The 1980 and the 1981 Schedules of the DOE Faculty Development Summer Energy Education Workshops at UMO

1980 Workshop Schedule

Ed X172 Workshop in Energy Education Concepts (Secondary)

and

Ed C123 Principles of Curriculum Construction (Energy)

A Workshop Program of the College of Education and
College of Engineering and Science
University of Maine at Orono

****

With funding from the U.S. Department of Energy

****

Major Staff Members:

- Lloyd H. Barrow, Project Director and Assistant Professor of Science Education
- John McDonough, Assistant Professor of Engineering Technology
- Constance M. Perry, Visiting Assistant Professor of Education
- Anne Pooler, Assistant Dean, Division of Curriculum and Instruction, and Assistant Professor of Education
- Karl Webster, Associate Professor of Mechanical Engineering Technology

Project Assistants:

Mary B. Brown - Project Secretary
Nancy Cobb - Clerical Assistant
Gisile Dunn - Clerical Assistant
Connie Holden - Laboratory and Curricular Assistant
Karen O'Neil - Laboratory and Curricular Assistant

NOTE: During this workshop, the staff will share their expertise about energy related materials and equipment. The disclaimer is because individuals have preferences such as some prefer Coke and others Pepsi. The preferences we express are matched with the conditions we are familiar with and might not be best for all conditions.

Workshop Schedule

Alternate Energy Workshop

July 7	Monday		
	8:30-10:00	Gannett Dorm (Lobby)	Registration
	9:30-10:00	140 Little	Refreshments
	10:00-10:15	140 Little	Welcome, Dean Robert Cobb, Dean Jim Clapp
	10:15-10:35	140 Little	Introduction of Staff-Dr. Barrow John McDonough Karl Webster Anne Pooler Constance Perry Connie Holden Karen O'Neil
	10:35-11:00	140 Little	Ice Breaker - Dr. Barrow
	11:00-11:50	140 Little	Orientation and evaluation
	12:00- 1:00	Stewart	Lunch
	1:00- 2:30	140 Little	Energy Demands & Resources: A Historical and Geographical Perspective-Edward Huff, Agricultural Engineering, UMO
	2:45- 4:30	140 Little	Why Alternate Sources? Dr. Perry
	7:00- 8:30		Social gathering - Dr. Barrow's 385 College Avenue
July 8	Tuesday		
	9:00-10:00	140 Little	Energy & Heat Transfer- Henry Metcalf, Engineering Technology & University Safety Engineering
	10:15-12:00	140 Little	Alternate Energy Sources of Maine-Wood, Solar, Hydro- Dr. Richard Hill, Mechanical Engineering, UMO
	12:00- 1:00	Stewart	Lunch
	1:00- 4:30	140 Little	Economic principles as they relate to energy-Dr. Pooler Economics and energy: Present and Future, Dr. Robert Mitchell, Executive Director of Maine Council of Economic Education

	6:30- 9:00	100 Nutting	Wood Harvesting Techniques - Bill Lilley, Forest Extension Service
July 9	Wednesday		
	9:00-11:00	140 Little	Energy Audit Procedures- Mr. McDonough & Mr. Webster
	11:00-12:00	140 Little	What is a Solar Energy Curriculum - Ms. O'Neil
	12:00- 1:00	Stewart	Lunch
	1:15- 3:00	140 Little	Wood Lot Management-Al Kimball State Forester, Old Town
	6:45- 7:30	203 Little	Coal as a fuel for Maine- Dr. Holden
	7:30- 8:15	203 Little	Economics of petroleum by-products - Ms. O'Neil
	8:15- 9:00	203 Little	Natural gas for Maine-Dr. Perry
July 10	Thursday		
	9:00-10:30	140 Little	Energy Audit-II-Mr. McDonough & Mr. Webster
	10:45-12:00	140 Little	Planning your interdisciplinary unit-Dr. Barrow
	12:00- 1:00	Stewart	Lunch
	1:00- 3:30	140 Little	Nulcear Energy- John E. Randazza Vice-President, Central Maine Power and Maine Yankee
July 11	Friday		
	8:00- 5:00		Conduct a home energy audit

July 14 Monday

9:00-10:00	140 Little	Energy Conservation Procedures Mr. Webster & Mr. McDonough
10:00-11:00	140 Little	Analysis of home energy audit-Dr. Perry
11:00-12:00	140 Little	Energy legislation-Dr. Pooler
12:00- 1:00	Stewart	Lunch
1:00- 3:00		Concurrent laboratories
	216 Shibles	Energy production of dried wood - Ms. O'Neil
	204 Shibles	Energy production of green wood - Dr. Holden
3:15- 4:30	140 Little	Home appliance demands on energy-Mr. McDonough
6:30- 8:00	203 Little	Assistance on developing unit-Staff (optional)

July 15 Tuesday

9:00-12:00	140 Little	Safety consideration of wood stoves-Cleaning of chimneys (schedule to be distributed)
12:00- 1:00	Stewart	Lunch
1:00- 2:00	140 Little	Solar Energy Lab - Ms. O'Neil
2:00- 2:30	140 Little	Energy Loss - Mr. McDonough
2:20- 3:00	140 Little	Testing insulation effectiveness-Mr. Webster
3:30- 5:30		Concurrent laboratories
	Crosby Labs	Storm Windows - Dr. Holden Caulking - Ms. O'Neil Weatherstripping-Mr. McDonough Insulating - Mr. Webster

July 16 Wednesday

9:00-12:00	140 Little	Hydroelectric generation-Dr. Bill Beardsley-Bangor Hydro Tour of Bangor Hydro plant in Old Town
12:00- 1:00	Stewart	Lunch

	1:00- 4:00	140 Little	Energy Simulators-Dr. Joelyn Sprowles-Bates College
	7:00- 9:00	203 Little	School energy audit procedures - Dr. Holden, Mr. McDonough, Ms. O'Neil & Mr. Webster
July 17	Thursday		
	9:00-12:00	140 Little	Utilization of Wood- Dr. Norman Smith, Engineering-UMO Tour of labs
	12:00- 1:00	Stewart	Lunch
	1:00- 3:30	140 Little	Practical Energy Options including Solar- Alan Lishness-Maine Audubon
July 18	Friday		
			Participants will conduct an energy audit of their school or classroom.
July 21	Monday		
	9:00-10:00	140 Little	Planning your own energy education workshop- Dr. Barrow
	10:00-11:00	140 Little	Site visitation, Don Deschenes
	11:00-12:00	140 Little	Help session in planning interdisciplinary unit- Project staff
	12:00- 1:00	Stewart	Lunch
	1:00- 3:00	140 Little	Field trip to solar home and solar hot water system - 495 College Ave. Orono Family Practice
	3:00- 3:30	130 Little	Energy and GNP - Dr. Pooler
	3:00- 8:00		Prepare and cook a solar cooked meal - Ms. O'Neil & Dr. Holden

July 22	Tuesday		
	8:00- 5:30		Tour Great Northern Paper Co., Millinocket, Bark Burner Construction Ripogenus Dam (fossil collecting weather permitting)
July 23	Wednesday		
	9:00-10:30	140 Little	Sharing of interdisciplinary unit topics
	10:30-12:00	140 Little	Work on interdisciplinary units
	12:00- 1:00	Stewart	Lunch
	1:00- 3:00	140 Little	Panel Government/Business Response to Energy
	3:00- 4:00	140 Little	Analysis of school audits-Ms. O'Neil & Dr. Holden
	6:30- 8:00	203 Little	Simulation Game on Energy-Steve Webster
July 24	Thursday		
	9:00-10:30	140 Little	Planning for Autumn Conference-Dr. Barrow & Dr. Perry
	10:30-11:30	140 Little	Evaluation
	12:00- 1:00	Stewart	Banquet and Awards-Dr Barrow and guest speaker John Joseph
	2:00- 3:30	140 Little	Check out/Workshop closure

1981 Workshop Schedule

Ed X172 Workshop in Energy Education Concepts (Secondary)

and

Ed C123 Principles of Curriculum Construction (Energy)

A Workshop Program of the College of Education and
College of Engineering and Science
University of Maine at Orono

****

With funding from the U.S. Department of Energy

****

Major Staff Members:

Lloyd H. Barrow, Project Director
and Assistant Professor of Science Education
John McDonough, Associate Professor of Civil Engineering Technology
Constance M. Perry, Visiting Assistant Professor of Education
Anne Pooler, Assistant Dean, Division of Curriculum and Instruction, and Assistant Professor of Education
Walter Turner, Professor of Electrical Engineering
Karl Webster, Professor of Mechanical Engineering Technology

Project Assistants:

Mary B. Brown - Project Secretary
Connie Holden - Laboratory and Curricular Assistant
Karen O'Neil - Laboratory and Curricular Assistant

NOTE: During this workshop, the staff will share their expertise about energy related materials and equipment. The preferences we express are matched with the conditions we are familiar with and might not be best for all conditions.

Workshop Schedule

Science, Economics & Technology of Energy

July 6	Monday		
	8:30-10:00	Dorm (Lobby)	Registration
	9:30-10:00	140 Little	Refreshments
	10:00-10:15	140 Little	Welcome, Dean Robert Cobb, College of Education and Dean James Clapp, College of Science and Engineering
	10:15-10:35	140 Little	Introduction of Staff-Dr. Barrow John McDonough Walter Turner Karl Webster Anne Pooler Constance Perry Connie Holden Karen O'Neil
	10:35-11:00	140 Little	Ice Breaker - Dr. Barrow
	11:00-11:50	140 Little	Orientation and evaluation
	12:00- 1:00	Stewart	Lunch
	1:00- 2:30	140 Little	Energy & Heat Transfer - Prof. George Clifford, Mechanical Engineering, UMO
	2:30- 2:45	140 Little	Break
	2:45- 3:45	140 Little	Energy History and Time Line - Dr. Perry
	3:45- 4:30	140 Little	Tour Library and Energy Resources - Dr. Holden and Ms. O'Neil
	7:00- 8:30		Social gathering - Dr. Barrow's- 385 College Avenue
July 7	Tuesday		
	8:30-10:00	140 Little	An Engineer Looks at Nuclear Energy: Particularly for Maine-Prof. Richard Hill, Mechanical Engineering, UMO
	10:00-10:15	140 Little	Break
	10:15-11:15	140 Little	Nuclear Regulatory Commission: Its Function and Operation- Prof. Turner

[illegible]

	11:15-12:15	140 Little	Sociological View of Nuclear Energy - Dr. James Gallagher, Sociology Dept., UMO
	12:15- 1:30	Stewart	Lunch
	1:30- 2:45	140 Little	Energy/Atmospheric Pollution/ Terrestrial and Aquatic Impact - Dr. Steve Norton, Geological Sciences, UMO
	2:45- 3:00	140 Little	Break
	3:00- 4:30	140 Little	Energy Audit Procedures I - Profs. McDonough and Webster
	6:30- 8:00	216 Shibles	Evaluating and up-dating A,B,C's of Energy - Dr. Barrow and staff
July 8	Wednesday		
	8:30- 9:15	140 Little	Coal as a Fuel - Dr. Holden
	9:15-10:00	140 Little	Economics of Petroleum By-Products - Ms. O'Neil
	10:00-10:15	140 Little	Break
	10:15-11:00	140 Little	Natural Gas for Maine-Dr. Perry
	11:00-12:00	140 Little	What is Energy Education? - Dr. Barrow
	12:00- 1:00	Stewart	Lunch
	1:00- 3:00	140 Little	Solar Energy Labs - Dr. Perry, Dr. Holden, Ms. O'Neil
	3:15- 5:30		Library Research - Individual Assistance
	6:30- 8:00	216 Shibles	Continue work on A,B,C's of Energy
July 9	Thursday		
	8:30-10:00	140 Little	Energy Audit II - Profs. McDonough & Webster
	10:00-10:15	140 Little	Break
	10:15-12:00	140 Little	Energy Simulator - Dr. Perry
	12:00- 1:00	Stewart	Lunch
	1:00- 3:00	216 Shibles	Energy Production of Dried Wood - Ms. O'Neil

		204 Shibles	Energy Production of Wet Wood - Dr. Holden
	3:00- 3:30	Shibles	Break
	3:30- 4:30	140 Little	Insulation-Prof. George Clifford
July 10	Friday		
	8:30-10:00	140 Little	Regulation and Operation of Utilities - Prof. Turner
	10:00-10:15	140 Little	Break
	10:15-12:00	140 Little	Individual Assistance Time
	12:00- 1:00	Stewart	Lunch
	1:00- 3:00	140 Little	Solar Cells and Solar Utilization-Dr. Henry Hooper, Physics, UMO
July 11	Saturday		
	8:00- 5:00		Conduct a Home Energy Audit at your personal site
July 13	Monday		
	9:00-10:15	216 Shibles	Analysis of Home Energy Audits-Profs. McDonough and Webster
	10:15-10:30	Shibles	Break
	10:30-12:00	216 Shibles	Economics and Energy: Friends or Foes? - Dr. Pooler
	12:00- 1:00	Stewart	Lunch
	1:15- 2:45		Field Trip to Solar Homes - 495 College Avenue
	2:45- 3:00	216 Shibles	Break
	3:00- 4:00		Field Trip to Solar Hot Water Systems -
	6:30- 8:00	216 Shibles	In-Service Techniques - Drs. Pooler, Perry & Barrow

July 14 Tuesday

8:30-11:00	140 Little	Hydroelectric Generation - Dr. Bill Beardsley, Bangor Hydro
11:00-12:00		Field Trip of Hydro Plant
12:00- 1:00		Lunch
1:00- 2:45	140 Little	History of Petroleum Industry - Dr. Arthur Johnson, History, UMO
2:45- 3:00		Break
3:00- 4:30	Crosby Labs/ Field Trips to homes being insulated	Storm Windows - Dr. Holden Caulking - Ms. O'Neil Weatherstripping - Prof. McDonough Insulating - Prof. Webster Passive Solar in the Everyday Home - Prof. Turner
6:30- 8:00	216 Shibles	Exemplary Energy Education Materials

July 15 Wednesday

8:30- 9:45	140 Little	Planning Your Teaching Unit - Dr. Barrow
9:45-10:00		Break
10:00-12:00	140 Little	Economics Principles - Dr. Robert Mitchell, Executive Director of Maine Council on Economic Education
12:00- 1:00	Stewart	Lunch
1:00- 4:00	140 Little	Utilization of Wood - Dr. Norman Smith, Agricultural Engineering, UMO, and Tour of Wood Chip Furnace Laboratory
6:30- 7:30	216 Shibles	Sharing of Energy Education Plans in Your School
7:30- 8:30	216 Shibles	Staff Development of Energy Educational Materials

July 16 Thursday

8:30- 9:45	140 Little	Wood Stove Safety - Bill Lilley, Forestry Extension
9:45-10:00		Break
10:00-12:00	140 Little	Home Energy Consumption Patterns - Profs. McDonough, Turner, and Webster
12:00- 1:00	Stewart	Lunch
1:00- 2:45	140 Little	In-Service Preparation
2:45- 3:00		Break
3:00- 4:00	140 Little	Energy Education in Maine - The Future - Ms. Christina Rule, Office of Energy Resources, Augusta, Mr. Doug Stafford, Department of Educational and Cultural Services, Augusta, and Dr. Barrow, UMO
4:00- 5:00	140 Little	Energy Legislation - Changing Position from Carter to Reagan - Dr. Pooler

July 17 Friday

8:30- 9:45	140 Little	Planning for Autumn Conference-Dr. Barrow
9:45-10:00		Break
10:00-11:30	140 Little	Evaluation - Dr. Barrow
11:45- 2:00		Banquet and Awards-Dr. Barrow Guest Speaker-Oz Berman, Office of Energy Resources, Augusta
2:30- 3:30		Check-out/Workshop Closure

APPENDIX B

Demographic Information About the 67 DOE Participants

ISC

Demographic Information About the 67 DOE Participants From the
U. S. Department of Energy Faculty Development Program
Attendance Summary, University of Maine Orono, Maine,
April 22, 1981 and May 21, 1982.

Variable Label	1980	1981
Number of participants completing the workshops:	38	29
From high schools (Grades 9-12)	20	15
From junior high schools (Grades 7-8)	17	13
From elementary schools (Grades K-6)	1	1
Number of female participants	8	6
Number of male participants	30	23
Number of participants by disciplines:		
Biology and Environmental Sciences	11	4
Chemistry and Physical Sciences	11	15
Earth Sciences	3	0
Industrial Arts and Home Economics	6	4
Social Studies	7	6

APPENDIX C

Cover Letters and
Survey Instruments

P. O. Box 88
Old Town, ME 04468
October 25, 1982

Dear Energy Educator:

This research study is using a mailed survey to investigate the effectiveness of energy education workshops. Please complete the Energy Education Survey for Participants and return it in the self-addressed stamped envelope by November 22, 1982.

Please select a fellow teacher who attended your local energy education workshop or project. If you do not have a fellow teacher who attended your local energy workshop or project, select a peer teacher who is familiar with your energy education project. In the selection of the one, please consider the following criteria: subject (i.e., science, social studies, or industrial arts), grade level, attitude toward energy, and years of teaching. If one teacher does not meet all criteria, try to find the one that best meets them. Give the selected teacher the stapled packet for the Energy Education Survey for Peer Teachers. If you are unable to select a peer teacher because you have changed schools since your DOE workshop participation, indicate on the peer form and return it to me.

Your cooperation in this research is very important to me. Your responses will be kept in strict confidence. Please return your completed Energy Education Survey for Participants by November 22, 1982. The code number on the form is for follow-up purposes only.

If you desire a summary of the results, please complete and return the bottom portion of this page with your completed survey.

Thank you for your cooperation.

A Fellow Teacher,

Betty L. Bitner
Business Phone:
1-207-581-7027, Ext. 25
Home Phone:
1-207-827-5294

= =

Please send me a sumary of the results of the Energy Education Survey for Participants.

Name: ______________________________

Address: ______________________________

____

P. O. Box 88
Old Town, ME 04468
October 25, 1982

Dear Teacher:

This research study is using a mailed survey to investigate the effectiveness of energy education workshops. Please complete the Energy Education Survey for Peer Teachers and return it in the self-addressed stamped envelope by November 22, 1982.

Your cooperation in this research is very important to me. Your responses will be kept in strict confidence. Please return your completed Energy Education Survey for Peer Teachers by November 22, 1982. The code on the form is for follow-up purposes only.

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Thank you for your cooperation.

A Fellow Teacher,

Betty L. Bitner
Business Phone:
1-207-581-7027, Ext 25
Home Phone:
1-207-827-5294

Please send me a summary of the results of the Energy Education Survey for Peer Teachers.

Name: ______________________________

Address: ______________________________

____

P. O. Box 88
Old Town, ME 04468
November 23, 1982

Dear Energy Educator:

Approximately one month ago, I mailed you two surveys, an Energy Education Survey for Participants and an Energy Education Survey for Peer Teachers, to investigate the effectiveness of energy education workshops. Thus far, I have received a 46% return of the participants and an 33% return of the peer teachers, but I desire to increase the return rate to 80% for the participants and 60% for the peer teachers. I appreciate your response, but I have not received the Energy Education Survey for Peer Teachers.

Please select a fellow teacher who attended your local energy education workshop or project. If you do not have a fellow teacher who attended your local energy workshop or project, select a peer teacher who is familiar with your energy education project. In the selection of the one, please consider the following criteria: subject (i.e., science, social studies, or industrial arts), grade level, attitude toward energy, and years of teaching. If one teacher does not meet all criteria, try to find the one that best meets them. Give the selected teacher the stapled packet for the Energy Education Survey for Peer Teachers. If you are unable to select a peer teacher because you have changed schools since your DOE workshop participation, indicate on the peer survey form and return it to me in the self-addressed stamped envelope by December 10, 1982.

Thank you for your cooperation.

A Fellow Teacher,

Betty L. Bitner
Business Phone:
207-[illegible], Ext. [illegible]
Home Phone:
207-[illegible]

P. O. Box 88
Old Town, ME 04468
November 23, 1982

Dear Energy Educator:

Approximately one month ago, I mailed you two surveys, an Energy Education Survey for Participants and an Energy Education Survey for Peer Teachers, to investigate the effectiveness of energy education workshops.

Thus far, I have received a 46% return of the participants and a 33% return of the peer teachers, but I desire to increase the return rate for participants to 80% and for peer teachers to 60%. Please complete the enclosed Energy Education Survey for Participants and return it in the self-addressed envelope by December 10, 1982.

Your cooperation in this research is very important to me. Your responses will be kept in strict confidence. The code number on the form is for follow-up purposes only.

If you desire a summary of the results, please complete and return the bottom portion of this page with your completed survey.

Thank you for your cooperation.

A Fellow Teacher,

Betty L. Bitner
Business Phone:
207-581-7027, Ext. 25
Home Phone:
207-827-5294

- -

Please send me a summary of the results of the Energy Education Survey for Participants.

Name: ____

Address: ____

____

P. O. Box 88
Old Town, ME 04468
November 23, 1982

Dear Energy Educator:

Approximately one month ago, I mailed you two surveys, an Energy Education Survey for Participants and an Energy Education Survey for Peer Teachers, to investigate the effectiveness of energy education workshops. Thus far, I have received a 46% return of the participants and a 33% return of the peer teachers, but I desire to increase the return rate to 80% for participants and to 60% for peer teachers. Please complete the Energy Education Survey for Participants and return it in the self-addressed stamped envelope by December 10, 1982.

Please select a fellow teacher who attended your local energy education workshop or project. If you do not have a fellow teacher who attended your local energy education workshop or project, select a peer teacher who is familiar with your energy education project. In the selection of the one, please consider the following criteria: subject (i.e., science, social studies, or industrial arts), grade level, attitude toward energy, and years of teaching. If one teacher does not meet all criteria, try to find the one that best meets them. Give the selected teacher the stapled packet for the Energy Education Survey for Peer Teachers. If you are unable to select a peer teacher because you have changed schools since your DOE workshop participation, indicate on the peer survey form and return it in the self-addressed stamped envelope to me by December 10, 1982.

Your cooperation in this research is very important to me. Your responses will be kept in strict confidence. The code number on the form is for follow-up purposes only.

If your desire a summary of the results, please complete and return the bottom of this page with your completed survey.

Thank you for your cooperation.

A Fellow Teacher,

Betty L. Bitner
Business Phone:
207-581-7027, Ext. 25
Home Phone:
207-827-5294

- -

Name: ____

Address: ____

____

P. O. Box 88
Old Town, ME 04468
November 23, 1982

Dear Teacher:

Approximately one month ago, I mailed your building's summer energy education workshop participant an Energy Education Survey for Peer Teachers to investigate the effectiveness of energy education workshops. This survey form you may or may not have received. Thus far, I have received a 33% return of the Energy Education Survey for Peer Teachers, but I desire to increase the return rate to 60%. Please complete the Energy Education Survey for Peer Teachers and return it in the self-addressed stamped envelope by December 10, 1982.

Your cooperation in this research is very important to me. Your responses will be kept in strict confidence. The code on the form is for follow-up purposes only.

If you desire a summary of the results, please complete and return the bottom portion of this page with your completed survey.

Thank you for your cooperation.

A Fellow Teacher,

Betty L. Bitner
Business Phone:
207-581-7027, Ext. 25
Home Phone:
207-827-5294

- -

Name: ____

Address: ____

____

ENERGY EDUCATION SURVEY FOR PARTICIPANTS

SECTION A: PRIOR PRACTICES RELATED TO ENERGY EDUCATION

1. Prior to my participation in the UMO summer energy education workshop, I had attended the following: (Check all that apply.)
   _____ no energy education workshop
   _____ one hour energy education workshop
   _____ half day energy education workshop
   _____ one day energy education workshop
   _____ more than a one day energy education workshop
   _____ a course on energy
   _____ other energy experiences (Please specify:__________________
   ____).

2. Had you conducted an energy education workshop prior to your participation in the UMO summer energy education workshop? (Check one.)

   _____ Yes _____ No

3. Please indicate below all the energy education topics you included in your courses before your participation in the UMO summer energy education workshop. (Check all that apply.)
   _____ Conventional energy: production and resources, i.e., coal, petroleum, nuclear, etc.
   _____ Economics of energy
   _____ Energy conservation and lifestyles, i.e., insulation, carpooling, mass transit, etc.
   _____ Energy and environmental interaction, i.e., acidic precipitation, strip mining, etc.
   _____ Future energy alternatives
   _____ History of energy
   _____ Home energy audits
   _____ Regulation and operation of utility companies
   _____ Renewable energy: production and resources, i.e., solar, wind, biomass, etc.
   _____ Scientific principles of energy
   _____ None
   _____ Other (Please specify:_____________________________________).

4. My principal informed me of the DOE workshop at UMO. (Check one.)

   _____ Yes _____ No

5. My principal encouraged me to apply for the DOE Energy Workshop. (Check one.)

   _____ Yes _____ No

SECTION B: CURRENT PRACTICES RELATED TO ENERGY EDUCATION

1. How do you recommend that energy education topics be included in any school curriculum? (Check all that apply.)
   _____ not taught
   _____ separate course, i.e., energy
   _____ unit within a course, i.e., integration
   _____ within a course but not a whole unit
   _____ other (Please specify: ________________________________).

2. How does your school currently handle energy education? (Check all that apply.)
   _____ assembly programs on energy
   _____ energy displays
   _____ energy fairs
   _____ integration into various disciplines, i.e., science, history, English, mathematics, and foreign languages
   _____ none
   _____ separate course, i.e., energy
   _____ team-teacher approach
   _____ unit within a course
   _____ within a course but not a whole unit
   _____ other (Please specify: ________________________________).

3. How do you currently teach energy education topics? (Check all that apply.)
   _____ not taught
   _____ separate course, i.e., energy
   _____ unit within a course, i.e., integration
   _____ within a course but not a whole unit
   _____ other (Please specify: ________________________________).

4. Rate your students on their energy conservation practices, e.g., turning off lights, and knowledge of energy-related topics at the beginning of the 1982-1983 school year. (Circle the appropriate number on the continuum from 1 to 5.

   a. Energy conservation practices, e.g., turning off lights, of energy-related topics:

   Inappropriate   Appropriate

   1   2   3   4   5

   b. Knowledge of energy-related topics:

   Poor   Good

   1   2   3   4   5

5. Please read carefully the following definition of energy education. Indicate your degree of agreement (strongly agree = 1; strongly disagree = 5).

Energy education is multifaceted, with historical, political, economic, ethical and moral, scientific and technological, occupational, psychological, environmental, and sociological implications; therefore, the public school system should offer a K-12 multidiciplinary approach to energy education.

Strongly agree Strongly disagree

1 2 3 4 5

6. Please indicate below all the energy education topics included in your 1982-1983 school curriculum. (Check all that apply.)
_____ Conventional energy: production and resources, i.e., coal, petroleum, nuclear, etc.
_____ Economics of energy
_____ Energy conservation and lifestyles, i.e., mass transit, insulation, carpooling, etc.
_____ Energy and environmental interaction, i.e., acidic precipitation, strip mining, etc.
_____ Future energy alternatives
_____ History of energy
_____ Home energy audits
_____ Regulation and operation of utility companies
_____ Renewable energy: production and resources, i.e., solar, wind, biomass, etc.
_____ Scientific principles of energy
_____ None
_____ Other energy topics (Please specify:________________________).

7. Please check below each of the types of materials that you use in teaching energy education topics. (Check all that apply.)
_____ business or industry produced energy education materials
_____ commerically produced textbooks
_____ films
_____ Project for an Energy-Enriched Curriculum (PEEC) materials
_____ resource speaker
_____ self-produced energy education units or materials
_____ not taught
_____ other (Please specify:__________________________________).

8. My principal helped me plan the local energy education workshop or project. (Check one.)

_____ Yes _____ No

9. My principal attended the local energy education workshop or project. (Check one.)

_____ Yes _____ No

10. Indicate the type of energy workshop(s) or project(s) you have conducted. (Check all that apply.)
_____ curriculum material display
_____ energy conservation
_____ energy facts and history
_____ energy fairs
_____ energy-related assemblies
_____ energy-related field trips
_____ energy sources and supply
_____ have not conducted a workshop yet
_____ National Energy Education Day Program
_____ outside speakers
_____ student involvement, i.e., dramatic presentation, projects, etc.
_____ other (Please specify:_________________________________).

11. Did you jointly conduct the local inservice energy workshop or project with another UMO energy workshop participant?

_____ Yes _____ No

SECTION C:
FACTORS INFLUENCING THE TEACHING OF ENERGY EDUCATION

Please circle below the degree to which you think the following factors have influenced your decision to teach energy education.

SA = Strongly agree
A = Agree
N = Neutral
D = Disagree
SD = Strongly Disagree

1.	My school district administration has encouraged energy education.	SA	A	N	D	SD
2.	My principal has encouraged other teachers to become involved in the local energy workshop or project planning.	SA	A	N	D	SD
3.	My school board has encouraged energy education.	SA	A	N	D	SD
4.	My community has support energy education.	SA	A	N	D	SD
5.	Students are interested in energy.	SA	A	N	D	SD
6.	Increase in teachers' personal convictions that energy education should have a high priority has influenced me.	SA	A	N	D	SD
7.	Energy education is as important as other curricular topics.	SA	A	N	D	SD
8.	I feel qualified to teach energy education.	SA	A	N	D	SD
9.	My principal currently emphasizes the need for energy concepts and issues in the school curriculum.	SA	A	N	D	SD
10.	My principal actively participated in the local energy education workshop or project.	SA	A	N	D	SD

SECTION D: BACKGROUND INFORMATION

1. Check the highest degree held.
_____ Associate _____ Bachelor _____ Master
_____ Certificate of Advanced Study _____ Doctorate

2. When did you receive your last degree? _____ year

3. How many years including 1982-1983 have you taught? _____ years

4. How many years including 1982-1983 have you taught in the present school? _____ years

5. How many years including 1982-1983 have you taught energy education? _____ years

6. What is the approximate student enrollment and grade of your building?
_____ students _____ grades

7. How many teachers are employed at your building? _____ teachers

8. a. If you are teaching during 1982-1983, check all appropriate grades.
_____ Below sixth grade
_____ Sixth grade
_____ Seventh grade
_____ Eighth grade
_____ Ninth grade
_____ Tenth grade
_____ Eleventh grade
_____ Twelfth grade

b. List all the subjects that your are teaching during 1982-1983.

______________________ ______________________
______________________ ______________________
______________________ ______________________
______________________ ______________________

c. If you are not teaching during 1982-1983, describe your position.

____
____

d. Was the position change the result of your participation in the UMO summer energy education workshop?

_____ Yes _____ Maybe _____ No

9. What is your primary home heating source? (Check one only.)
_____ oil _____ natural gas _____ active solar system
_____ wood _____ coal _____ passive solar system
_____ electric _____ other (Please specify:______________________).

10. What is your supplemental home heating source? (Check all that apply.)

_____ oil
_____ wood
_____ coal
_____ natural gas
_____ kerosene
_____ electric
_____ passive solar system
_____ active solar system
_____ none
_____ other (Please specify:________________________________).

11. Please check. Sex: _____ Male _____ Female

12. Circle the age category that describes you.

a. 20-30 b. 31-40 c. 41-50 d. 51-60 e. 61 and over

Please feel free to comment.

Thank you.

ENERGY EDUCATION SURVEY FOR PEER TEACHERS

SECTION A: PRIOR PRACTICES RELATED TO ENERGY EDUCATION

1. Were you aware of the Department of Energy summer energy education workshop at the University of Maine at Orono during the summers of 1980 and of 1981? (Please check.)

   ______ Yes ______ No

   Did you apply for either summer energy workshop at UMO?

   ______ Yes ______ No

2. Prior to my participation in the local inservice energy education workshop, I attended the following: (Check all that apply.)
   _____ no energy education workshop
   _____ one hour energy education workshop
   _____ half day energy education workshop
   _____ one day energy education workshop
   _____ more than a one day energy education workshop
   _____ a course on energy
   _____ other energy experiences (Please specify:____________________ ____).

3. Please indicate below all the energy education topics you included in your curriculum before your participation in the local inservice energy education workshop. (Check all that apply.)
   _____ Conventional energy: production and resources, i.e., coal, petroleum, nuclear, etc.
   _____ Economics of energy
   _____ Energy conservation and lifestyles, i.e., insulation, carpooling, mass transit, etc.
   _____ Energy and environmental interaction, i.e., acidic precipitation, strip mining, etc.
   _____ Future energy alternatives
   _____ History of energy
   _____ Home energy audits
   _____ Regulation and operation of utility companies
   _____ Renewable energy: production and resources, i.e., solar, wind, biomass, etc.
   _____ Scientific principles of energy
   _____ None
   _____ Other (Please specify:______________________________).

SECTION B: CURRENT PRACTICES RELATED TO ENERGY EDUCATION

1. How do you recommend that energy education topics be included in any school curriculum? (Check all that apply.)
_____ not taught
_____ separate course, i.e., energy
_____ unit with in a course, i.e., integration
_____ within a course but not a whole unit
_____ other (Please specify:_______________________________).

2. How do you currently teach energy education topics? (Check all that apply.)
_____ not taught
_____ separate course, i.e., energy
_____ unit within a course, i.e., integration
_____ within a course but not a whole unit
_____ other (Please specify:_______________________________).

3. Rate your students on their energy conservation practices, e.g., turning off lights, and knowledge of energy-related topics at the beginning of the 1982-1983 school year. (Circle the appropriate number on the continuum from 1 to 5.)

a. Energy conservation practices, e.g., turning off lights, of energy-related topics:

Inappropriate Appropriate

1 2 3 4 5

b. Knowledge of energy-related topics:

Poor Good

1 2 3 4 5

4. Please read carefully the following definition of energy education. Indicate your degree of agreement (strongly agree = 1; strongly disagree = 5).

Energy education is multifaceted, with historical, political, economic, ethical and moral, scientific and technological, occupational, psychological, environmental, and sociological implications; therefore, the public school system should offer a K-12 multidiciplinary approach to energy education.

Strongly agree Strongly disagree

1 2 3 4 5

5. Please indicate below all the energy education topics you have included or will include in your 1982-1983 school curriculum. (Check all that apply.)
_____ Conventional energy: production and resources, i.e., coal, petroleum, nuclear, etc.
_____ Economics of energy
_____ Energy conservation and lifestyles, i.e., mass transit, insulation, carpooling, etc.
_____ Energy and environmental interaction, i.e., acidic precipitation, strip mining, etc.
_____ Future energy alternatives
_____ History of energy
_____ Home energy audits
_____ Regulation and operation of utility companies
_____ Renewable energy: production and resources, i.e., solar, wind, biomass, etc.
_____ Scientific principles of energy
_____ Other ______________________________.

6. Please check below each of the types of materials that you use in teaching energy education topics. (Check all that apply.)
_____ business or industry produced energy education materials
_____ commercially produced textbooks
_____ films
_____ Project for an Energy-Enriched Curriculum (PEEC) materials
_____ resource speaker
_____ self-produced energy education units or materials
_____ not taught
_____ other (Please specify: ______________________________).

SECTION C:

FACTORS INFLUENCING THE TEACHING OF ENERGY EDUCATION

Please circle below the degree to which you think the following factors have influenced your decision to teach energy education.

SD = Strongly disagree
D = Disagree
N = Neutral
A = Agree
SA = Strongly agree

1.	My school district administration has encouraged energy education.	SD	D	N	A	SA
2.	My building principal has encouraged energy education.	SD	D	N	A	SA
3.	My school board has encouraged energy education.	SD	D	N	A	SA
4.	My community has supported energy education.	SD	D	N	A	SA
5.	Students are interested in energy.	SD	D	N	A	SA

6.	Increase in teachers' personal convictions that energy education should have a high priority has influenced me.	SD	D	N	A	SA
7.	Energy education is as important as other topics.	SD	D	N	A	SA
8.	I feel qualified to teach energy education	SD	D	N	A	SA

SECTION D: BACKGROUND INFORMATION

1. Check the highest degree held.
   _____ Associate _____ Bachelor _____ Master
   _____ Certificate of Advanced Study _____ Doctorate

2. When did you receive your last degree: _____ year

3. How many years including 1982-1983 have you taught? _____ years

4. How many years including 1982-1983 have you taught in the present school? _____ years

5. How many years including 1982-1983 have you taught energy education? _____ years

6. Check below all the grades you are teaching during 1982-1983.
   _____ Below sixth grade
   _____ Sixth grade
   _____ Seventh grade
   _____ Eighth grade
   _____ Ninth grade
   _____ Tenth grade
   _____ Eleventh grade
   _____ Twelfth grade

   List all the subjects you are teaching during 1982-1983.

   ______________________________ ______________________________
   ______________________________ ______________________________
   ______________________________ ______________________________
   ______________________________ ______________________________
   ______________________________ ______________________________

7. What is your primary home heating source? (Check one only.)
   _____ oil _____ natural gas _____ active solar system
   _____ wood _____ coal _____ passive solar system
   _____ electric _____ other (Specify:______________________________)

8. What is your supplemental home heating source? (Check all that apply.)
   _____ oil _____ natural _____ passive solar system
   _____ wood _____ coal _____ active solar system
   _____ electric _____ kerosene _____ none
   _____ other (Specify:______________________________)

9. Please check. Sex: _____ Male _____ Female

10. Circle the age category that describes you.
    a. 20-30 b. 31-40 d. 51-60 e. 61 and over

Please feel free to comment.

Thank you.

APPENDIX D

Student Enrollment at the DOE Participants' Schools

Frequency Distribution of the Student Enrollment at the DOE Participants' Schools

Variable Label	n	%
Student Enrollment		
100 or less		
1980	2	7.2
1981	1	4.5
Total	3	6.0
100-300		
1980	6	21.5
1981	2	9.0
Total	8	16.0
301-500		
1980	1	3.6
1981	5	22.6
Total	6	12.0
501-1000		
1980	16	57.2
1981	8	36.2
Total	24	48.0
1001-1500		
1980	1	3.6
1981	4	18.1
Total	5	10.0
1500+		
1980	1	3.6
1981	0	0.0
Total	1	2.0
NA		
1980	2	7.1
1981	2	9.1
Total	4	8.0

Range	46-1450 students
Mean	564.480
S.D.	376.522

APPENDIX E

Teachers Employed at the DOE Participants' Schools

Frequency Distribution of the Teachers Employed at the DOE Participants' School

Variable Label	n	%
Teachers Employed		
NA		
1980	4	14.3
1981	3	13.6
Total	7	14.0
Less than 10		
1980	2	7.2
1981	0	0.0
Total	2	4.0
10-25		
1980	7	25.2
1981	6	27.0
Total	13	26.0
26-50		
1980	13	46.5
1981	8	36.0
Total	21	42.0
51-100		
1980	2	7.2
1981	5	22.6
Total	7	14.0

Range	4-93 teachers
Mean	31.580
S.D.	23.261

APPENDIX F

Grades Included in the DOE Participants' Schools

Frequency Distribution of the Grades Included in the DOE Participants' Schools

Variable Label	n	%
Grades		
K-6		
1980	1	3.6
1981	0	0.0
Total	1	2.0
K-8		
1980	1	3.6
1981	0	0.0
Total	1	2.0
6-8		
1980	1	3.6
1981	2	9.1
Total	3	6.0
9 or 10-12		
1980	15	53.6
1981	8	36.4
Total	23	46.0
7-9		
1980	3	10.7
1981	3	13.6
Total	6	12.0
K-12		
1980	4	14.3
1981	0	0.0
Total	4	8.0
Other		
1980	3	10.7
1981	3	13.6
Total	6	12.0
NA		
1980	1	3.6
1981	2	9.1
Total	3	6.0

APPENDIX G

Approaches Utilized by the DOE Participants' Schools for Incorporating Energy Education into the School Curriculum

Frequency Distribution of the Approaches Utilized by the DOE Participants' Schools for Incorporating Energy Education into the School Curriculum

Variable Label	n	%
Curricular Approach		
Assembly programs on energy		
1980	1	3.6
1981	3	13.6
Total	4	8.0
Energy displays		
1980	1	3.6
1981	2	9.1
Total	3	6.0
Energy fairs		
1980	1	3.6
1981	2	9.1
Total	3	6.0
Integration into various disciplines		
1980	18	64.3
1981	15	68.2
Total	33	66.0
Separate course		
1980	1	3.6
1981	2	9.1
Total	3	6.0
Team-teacher approach		
1980	1	3.6
1981	2	9.1
Total	3	6.0
Unit within a course		
1980	11	39.3
1981	12	54.5
Total	23	46.0
Within a course but not a whole unit		
1980	11	39.3
1981	6	27.3
Total	6	12.0
Other		
1980	5	17.9
1981	1	4.5
Total	6	12.0
None		
1980	0	0.0
1981	1	4.5
Total	1	2.0

BIOGRAPHY OF THE AUTHOR

Betty Lorraine Bitner was born February 7, 1945, in Greencastle, Pennsylvania. She graduated from the Waynesboro Area Senior High School Waynesboro, Pennsylvania, in 1963, and received a Bachelor of Arts Degree in Classical Languages from Thiel College, Greenville, Pennsylvania, in 1967.

After two years as a Latin teacher at Jamestown High School, Jamestown, New York and after extensive volunteer work with mentally handicapped clients and pre-school children, she decided to pursue a Master of Education in Mental Retardation at Edinboro State College, Edinboro, Pennsylvania, where she was a graduate research assistant. In 1971, she interrupted her full-time studies to accept a position to teach potential dropout students, ages 10-18, in the Jamestown Public School System. She received her Master of Education in Mental Retardation from Edinboro State College in 1973. Not only did Ms. Bitner teach Latin and potential dropout students in the Jamestown Public School System, but also she taught mentally handicapped and gifted and talented students. She was employed by the Jamestown Public School System for nine years. Then she moved to Rockport, Maine, in 1978 to accept a Latin and English teaching position at Rockland District High School where she taught until she moved to Orono, Maine, in August, 1981.

During the two years in graduate school at the University of Maine at Orono, she served as a graduate research assistant during 1981-1982 and as a graduate teaching assistant in Human Growth and Development and in Science Methods in the Elementary School courses during 1982-1983 in the College of Education. In addition, she was employed by the University of Maine at Augusta during the spring semester of 1983 to teach Science Methods in the Elementary School. Ms. Bitner is a candidate for the Doctor of Education Degree in Science Education from the University of Maine at Orono, May, 1983.